TRANSACTIONS

OF THE

Odontological Society of Great Britain.

VOL. XXV.—NEW SERIES.

Bavaud, Limited. *Woodburytype*

CHARLES S. TOMES.

F.R.S., M.R.C.S., ENG., L.D.S., ENG.

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ODONTOLOGICAL SOCIETY

OF

GREAT BRITAIN

VOLUME XXV.—NEW SERIES

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Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING,

November 7th, 1892.

MR. J. H. MUMMERY, M.R.C.S., L.D.S.

PRESIDENT, IN THE CHAIR.

The PRESIDENT, on taking the chair, said he desired to address a few words of welcome to the members at the commencement of a fresh session. He said it was his painful duty to record the loss by death of three members since their last meeting, viz., Mr. Charles Vasey, an original member, who had held the posts of President, Librarian, and Secretary, and was elected an honorary member in 1888 on his retirement from practice; his geniality and kindness had won the esteem of all who knew him, and the President was sure that they would all hear with great regret of his loss. Mr. Richard White, of Norwich, had also gone over to the majority; he, too, was an original member, and constituted a link with the past. He retired from the membership of the Society five or six years ago, but the Council, considering his long connection with them, had decided, with the approval of the Members, to send a vote of condolence to his family. They had also lost Mr. Edmund Kelly, who joined the Society in 1876.

Mr. JOSIAH MANSBRIDGE, M.R.C.S., L.R.C.P., L.D.S., of 112, Harley Street, was, at the April meeting of the Society

balloted for and duly elected a Resident Member of the Society.

The Minutes of the previous meeting having been read and confirmed,

Messrs. A. R. Colyer, P. Edgelow, J. Mansbridge, W. Rushton, and T. H. G. Wrighton, having signed the Obligation Book, were formally admitted Members by the President.

The President announced that he had also received duly signed obligation forms from the following Non-resident Members:—Mr. W. D. Moon, of Newcastle; Mr. J. Amoore, of Edinburgh; and Mr. P. B. Reading, of Sydney, Australia; and he declared them admitted as Non-resident Members of the Society.

Mr. H. W. Stoner, L.D.S.Eng., of Tylney House, 110, Queen's Road, Brighton, was nominated for Non-resident Membership.

The Secretary, in the absence of the Librarian, Mr. Ashley Gibbings, read the Librarian's Report, which stated that since the last meeting the following books had been presented by the authors:—"Address to the Students of University College," by S. J. Hutchinson; "Notes on Dental Practice," by Henry C. Quinby (two copies); and "Note Book for Dental Students: Dental Anatomy and Physiology," by J. F. Rymer. The following books had been added to the Library by purchase:—"Odontalgia," by S. Parsons Shaw; "Dentition as Indicative of the Age of the Animals of the Farm," by Prof. G. T. Brown; and "Elements of the Anatomy and Diseases of the Teeth," by H. T. Kempton, F.L.S. They had also received *The Transactions of the Royal Dublin Society*, and the *Proceedings of the Royal Society*.

The Curator (Mr. Storer Bennett), in reply to the President, said that he had no report to present.

The President called upon Mr. E. Lloyd-Williams for a Casual Communication.

Mr. E. Lloyd Williams said that he did not propose to occupy the time of the Society for more than two minutes, while he brought to their notice a case of a supernumerary tooth in an infant aged two years. The case had occurred in the out-patient department of the Westminster Hospital a week previously. The tooth was cut at 13 months, and a model was taken when the child was 2 years and one day old. The condition he believed to be rather rare, and was, in fact, the only one that he himself had seen of the kind. The tooth itself was rather interesting from the fact that at first sight it appeared to be a supplemental central incisor, but on examination it proved to be a supernumerary tooth with a conical cusp on its lingual aspect. He had much pleasure in presenting the model and tooth to the Museum, which was not very rich in cases of this sort.

The President thought the case interesting, and the Museum would be very glad to have it. He should be glad to hear the comments of members upon it.

Mr. David Hepburn remarked that he had had an opportunity of examining Mr. Lloyd Williams' model, and it seemed a similar case to one sent to him by Mr. J. F. Corbett, who at that time was resident in Dublin. This case he showed to the Society about twelve years ago. He had the tooth by him now; perhaps Mr. Corbett, who was present, would be able to give them some more information about it.

Mr. J. F. Corbett regretted to say that he did not take a model of the child's mouth. There were two supernumerary teeth; the child had all the temporary teeth standing, and these two were behind the two lower centrals.

Mr. Ackery mentioned that he had reported a case about ten years ago, in which there were two supernumeraries for supplemental temporary teeth in the lower jaw; they were right inside the arch, posterior to the lateral and canine on either side. The interesting feature of the case was that he was able to show the patient after an interval of six or seven years, when the permanent teeth were erupted.

There were then four normal incisors, two supernumeraries, and two persistent temporary teeth. The models of the case in both its phases were in the Society's Museum.

Mr. M. Hopson some three years ago had a case of a supernumerary in the upper jaw removed from the mouth of a child aged 6; it geminated with the left central. He had the specimen and should be pleased to present it to the Society.

Mr. Henri Weiss exhibited a mouth mirror constructed from designs of his own by Messrs. Ash and Sons. He pointed out that the object of the contrivance was to obtain a view of the upper teeth, particularly the incisors, at the same time leaving both hands free, by having the mirror attached to the lower teeth. Many similar mirrors had from time to time been introduced by the profession, but he claimed for this one a wider field of vision, and a satisfactory and simple means of attachment. It consisted of two parts, the mirror with ball and socket movement, and a clamp. The mirror and clamp could be detached, so that mirrors and clamps of various designs could be interchanged to serve the special requirements of the case. By leaving both hands free, the preparation and filling of distal cavities became a very easy matter. He apologised for not having one mounted on a mannikin to illustrate its use, but desiring to bring it before the Society as an original communication, and Messrs. Ash having only that day delivered these copies, he was unable to do so.

The President remarked upon the extremely interesting and ingenious character of Mr. Weiss' contrivance, and subsequently called upon Mr. Storer Bennett for his paper.

On some Mechanical Devices for the Retention of Artificial Dentures.

By Storer Bennett, F.R.C.S.Eng., L.R.C.P.Lond., L.D.S.Eng.

Mr. President and Gentlemen, — Having been engaged for some time in an endeavour to improve the method of constructing bands, by which artificial plates are steadied and held in position, I beg to lay before you the results of some experiments aimed at the production of hinged bands, whereby teeth may be clasped around their most constricted portions, unimpeded, nay even assisted by, the overhanging and expanded portions of their crowns.

From this variation in construction we are enabled to ensure more accurately fitting plates, and, in many instances, to effect a material reduction in their size. These bands are of two varieties, the first being self-adjusting, and is designed on the principle of the spring rings frequently attached to watch chains, while the other is a modification of the ordinary brooch joint.

The self-adjusting band is made by taking a piece of thin gold tube, about $\frac{3}{8}$ of an inch long, the width exactly corresponding to No. 14 stan-

dard iron wire gauge. One end of the tube is made solid for about $\frac{1}{16}$ of an inch by soldering into it a piece of gold wire, while the inside of the opposite extremity is tapped with a screw for $\frac{1}{32}$ of an inch. A slot is sawn through the middle of the solid extremity parallel to its long axis, and carried as far back as the hollow part, or tube, and rather farther on one side than the other. Into the slot a flat piece of gold is fitted, to form the tongue, or middle portion of a hinge,

FIG. 1.

Plate with two self-adjusting bands. The dotted lines indicate the amount to which the bands can be opened.

the width of the tube, but projecting slightly beyond its anterior extremity; the opposite extremity of the tongue reaching as far back as the short side of the slot. A hole is next drilled through the solid part of the tube and the tongue, at right angles to the slot, and a pin is passed through them and ultimately riveted or screwed. A band having been accurately fitted to the model,

is soldered to the anterior extremity of the tongue, and when this is replaced in the slot and transfixed by the pin the whole forms a hinged band. A piece of extended spiral spring is now thrust into the open end of the tube until it presses against the tongue, and is then held in position by a small gold plug screwed into the tube behind it.

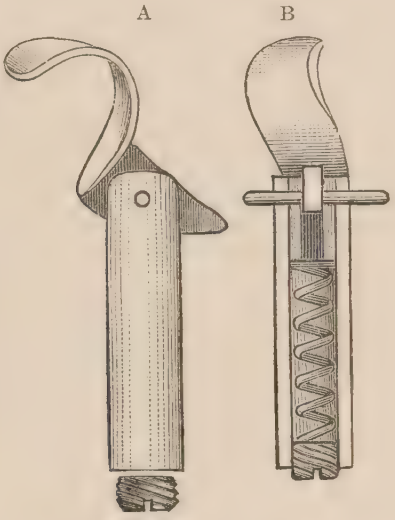

FIG. 2.
Mechanism of self-adjusting bands: A, elevation; B, section.

It will greatly facilitate rapid and accurate cutting of the slot if a piece of steel tube with a slot in one end, called a template, is used as a guide; and if a hole is drilled in the template across the slot it ensures the hole in the gold tube being properly placed.

The band so formed may be attached to a gold plate, by removing the spring and soldering the tube in the most suitable position, the spring being

subsequently replaced and retained by the screw plug. Where vulcanite is used it is necessary, before packing, to fill in the slot with a little osteo, to prevent the ingress of rubber, the osteo being subsequently dissolved away with hydrochloric acid.

Such a band will automatically open and close as it reaches the expanded or contracted portions

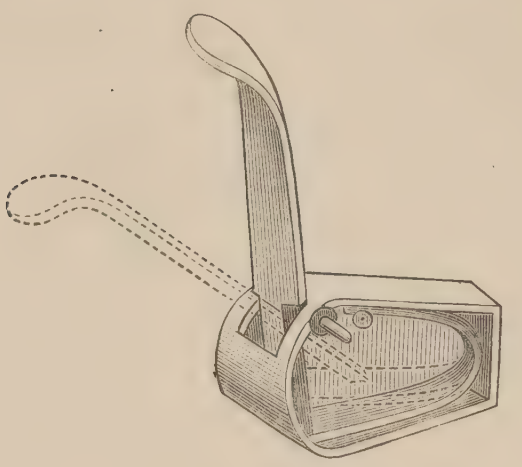

FIG. 3.

Enlarged view of section of locking band, showing position of the lever and spring when the band is open, and in dotted lines when it is closed.

of a tooth, when it is necessary either to insert or remove the plate, and will be found most useful in the very class of cases in which an ordinary band fails. While the spring effectually retains the band in contact with the constricted portion of the tooth, it readily allows it to be opened, and thus avoids the friction and resulting pain, that so frequently accompany the use of tight bands.

In some cases it is useful to employ a band which can be opened, and will remain fixed in this position while the plate is being inserted or removed from the mouth; the band then being closed, and remaining immovably fixed until it is intentionally opened again.

In this case the band is soldered to the piece of tube which forms the central portion of a brooch joint, the band being carried sufficiently beyond the tube to press on a small

FIG. 4.

Wedge-shaped space with base towards the gum, to which a small plate may be adapted by the use of locking bands.

flat spring, bent into the shape of a horse-shoe magnet. This causes the joint to open or close with a snap, the spring locking the band securely in either position.

In order to prevent the ingress of rubber during packing, or of food when in use, the joint and spring are enclosed in a small gold box—which measures only $\frac{3}{16}$ of an inch in its largest diameter—which can be soldered to a plate or embedded in vulcanite.

Cases sometimes present themselves in which but one or two teeth—say a second bicuspid and first molar—have been lost on one side of the mouth only, the resulting space being wedge-shaped, with the base towards the gum, from the tilting of the adjoining teeth. The

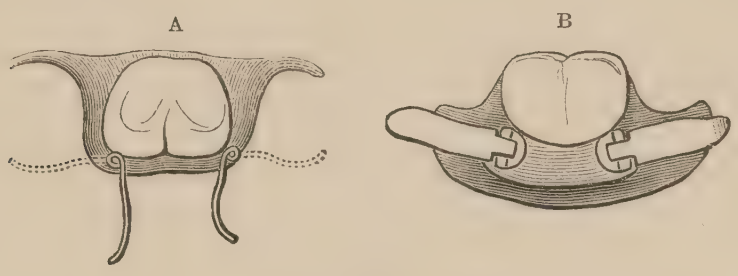

FIG. 5.

Small plate to fit into the gap seen in figs. 4 and 6; A seen from above, B from the buccal aspect.

difficulty of treating such cases is obvious, for either the plate is too large to pass between the approximated crowns, or when in position is very loose, from the gaps which must exist between the plate and the necks of the natural teeth.

Such cases are usually treated — if treated at all—by inserting a plate which covers a large portion of the mouth, in order to insure due steadiness and safety. So large a plate is a source of such inconvenience to the wearer, that in many instances its use is abandoned, and the patient is, therefore, frequently dissuaded from having such a gap filled up at all.

Now I think it will be admitted that the smaller we can make our plates—having due regard to their safety, steadiness, and ease of insertion and removal—the better. The patient will experience much greater comfort, and less damage can be done to teeth in remote portions of the mouth.

If we make use of the locking bands just described, the treatment of such cases becomes easy. A plate no larger than the space, but

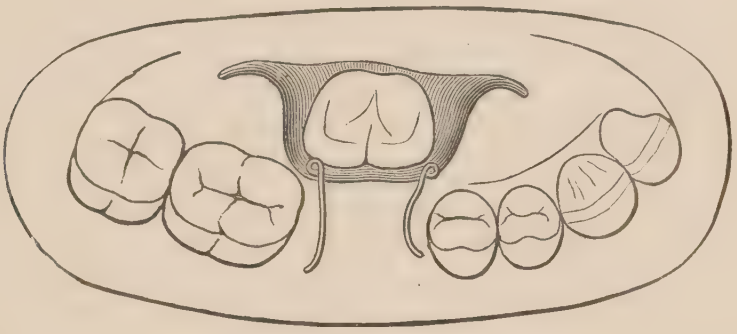

FIG. 6.

Showing method of inserting plate from the lingual aspect of the teeth, to dovetail into wedged-shape space, the locking bands being open.

which it accurately fits, has ordinary bands adjusted to the lingual surface of the tooth in front and behind the gap. Two locking bands are then adapted to the labial surfaces of these teeth in such a way that, when open, they are no wider than the width of the gap. Such a plate, when placed in the mouth with the bands open, may be dovetailed into position by pushing it outwards from the lingual towards

the buccal surface, and is secured by closing the bands, the overhanging crowns effectually preventing any upward displacement.

Instead of a back tooth, a front one may be lost, leaving the same wedge-shaped space with the base towards the gum, and needing the same large-sized plate to carry the artificial substitute. This may, however, be obviated

FIG. 7.

Wedge-shaped space with base towards the gum, in the incisor region.

in the following manner:—The back of a flat tooth is connected to a very small plate by a hinge, extending from one side of the gap to the other. By this means the tooth may be turned out of the way while the plate is pushed into position, by being drawn forward by its cervical extremity until it has assumed a horizontal direction. By closing the hinge the tooth becomes vertical, and is securely locked into position.

For such a purpose a small piece of plate is

accurately fitted to the gap, and a band adjusted to the lingual surface of the tooth on either side. A thin, flat tooth, having the pins as near the

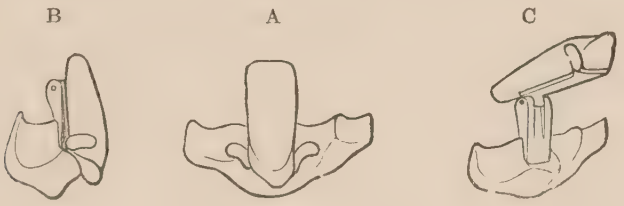

FIG. 8.

Hinged tooth arranged to fit the gap in fig. 7. A seen from the front, B and C from the side; B closed, and C open, ready to be placed in position.

cervix as possible, is backed and fitted in the usual manner, a small band, however, being soldered to each side of the backing, so as to fit the buccal surface of the necks of the adjoining teeth.

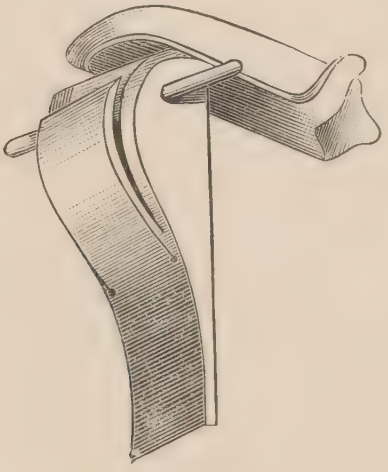

FIG. 9.

Enlarged view of the mechanism of hinged tooth.

A piece of 12-carat gold, the width of the space, has two parallel cuts made in it with a pair of shears, extending through about three-quarters

of its length, converting it into a figure somewhat resembling a comb with three equal teeth. The back of the comb is soldered to the plate so that the comb lies exactly behind the backing of the mineral tooth. A piece of thin gold tube is next soldered to the top of the two outer teeth of the comb, and cut away from the central one. This central piece of tube is soldered to the back-

FIG. 10.

Lower central incisor on small plate, with blade arranged to press on approximal surface of right lateral, by means of spring bolt travelling laterally. A seen from the front, B from above.

ing of the tooth, so that when a pin is thrust through the tubes, the tooth is connected to the plate by a brooch joint. If at the same time a little tongue of gold is soldered to the central tube so as to press on the middle portion of the comb, this, being a spring, will press on and retain the artificial tooth, either in a horizontal or vertical position.

When these small buccal bands are too conspicuous, from the necks of the teeth being frequently displayed, an artificial tooth may be retained in the dovetailed space by small blades

pressed against the approximal surfaces of the adjoining teeth, by means of a spiral spring.

A small plate, the size of the gap, is struck up, and its sides reduced until it will just pass through the narrowest part of the space between the neighbouring teeth. A flat tooth is backed and fitted in the usual manner. Two thin blades are then fitted to the necks of the approximal surfaces of the adjoining teeth, and one is

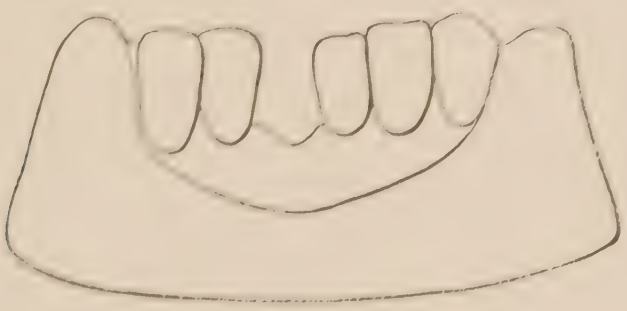

FIG. 11.

Model of case for which fig. 10 was adapted.

soldered to the plate. A small piece of square gold tube is next soldered, so that it lies transversely across the gap, immediately behind the backing of the tooth, and closed at one end by being in contact with the blade. A piece of square wire, which fits the tube, but not so long as it, is next soldered by one end to the other blade, so that when all are in position the wire will lie inside the tube. A slot is next cut in the upper surface of the tube, parallel to its long axis, but not extending as far as either

end, and a small hole is drilled and tapped in the wire, so that a screw may pass through the slot and retain the pin wire in the tube, at the same time allowing it to travel inwards and outwards for a short distance.

If a fine extended spiral spring is thrust into the tube in front of the wire, and the latter is screwed into position, the spring will tend tc push the wire and blade outwards against the adjoining tooth, and so retain the artificial one in position.

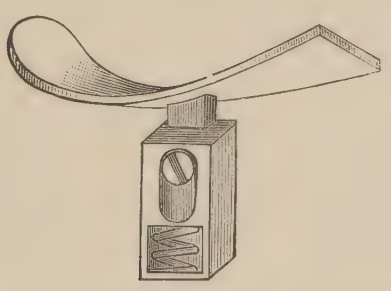

Fig. 12.

Enlarged view, partly in section, of the mechanism of spring bolt and blade of fig. 10.

An objection will at once suggest itself that the lateral pressure on the natural teeth will tend to loosen and displace them; though this seems probable, the spring employed is so weak, that such an unfortunate result has not hitherto occurred.

At one time I hoped that the alloy known as nickel-steel would prove of value to us, from its elasticity and non-liability to rust. So much difficulty, however, is experienced in combining

such a quantity of nickel with the steel as will prevent oxidation, and yet not impair the elasticity of the steel, that up to the present its use has proved impracticable for our purposes. Gold has therefore been the material employed, in the construction of the springs previously described, the alloys found most useful being :—

		Dwts.	Grs.
For spiral springs 15 carat	F.G.	12	12
	F.S.	2	12
	F.C.	5	0
	Oz. troy	20	0

		Dwts.
For all the other springs 12 carat, pale	F.G.	10
	F.S.	6
	F.C.	4
	Oz. troy	20

While the original patterns of the foregoing devices were in each case constructed in my own workroom, I have found it more convenient to have the subsequent ones made by a jeweller, Mr. Baker, of 55, Great Marlborough Street, W., from whom they may be obtained.

Discussion.

The President said that the paper to which they had listened was a very interesting and valuable one; they had always thought hitherto that hinged teeth were peculiar to fishes. Mr. Storer Bennett had shown a large amount of ingenuity in the contrivance of the band; it seemed to him that the small lower denture got over a serious difficulty in an effectual manner.

Mr. Henri Weiss said that Mr. Storer Bennett had dealt with the subject in such a thorough and lucid manner, and had explained his processes so fully, that it seemed that there was little left to be said. He gathered that there was no steel employed, so that there would be no degeneration in the apparatus by constant wear. Would there not be the liability of an accumulation of tartar which would retard its action?

Mr. T. S. Carter (Leeds) wished to ask Mr. Bennett if the patients themselves found any difficulty in opening the clasps? and also, how he managed to increase the strength of the clasps? Some patients liked them held lightly, others very firmly; there appeared to be no regulating medium.

Mr. David Hepburn said that if the paper did not call forth any very animated discussion he trusted that Mr. Storer Bennett would not infer that it was from any lack of interest. It appeared to him (Mr. Hepburn) to be a communication of the greatest possible interest, but it was not easy fully to grasp the process and form a sound judgment upon it at a first hearing; in order to discuss the method with any advantage it was necessary to carefully examine the specimens. From a cursory glance he felt that they were most ingenious, and that they were greatly indebted to Mr. Storer Bennett for having brought the subject before

them in so able a manner. The only point of criticism that occurred to him at the moment was in connection with the hinged teeth; it seemed to him that in many cases the hinges would interfere with the bite, especially in cases of a close bite. In the illustration marked D the weak point seemed to be the little stud with which the spring was worked. With regard to the particular stud in the illustration, he thought it too long, and that no spring would work satisfactorily with it; apart from that he thought that the ingenuity shown was so great that he would not like to discuss it without first examining the specimens.

Mr. F. J. Bennett, having had the opportunity of examining the specimens from time to time, felt convinced that much which might appear obscure and difficult to understand from a rapid description and rough diagrams, would become clear and easy of comprehension on a careful examination of the complete specimens standing on the models. They appealed to him very strongly as being clever inventions. With regard to the swivels, he might say he thought there was no more difficulty in the apparatus employed here than in the adaptation of them found in cases where swivels were ordinarily employed. No doubt Mr. Storer Bennett would be able to say how long the cases had taken to make, but he believed that they did not take very long, and that no very scientific training was required. Another point was that these cases were not merely untried specimens, but cases that had been worn for more than a year; they were therefore removed from the category of scientific toys, and might be regarded as tried inventions. With regard to the stud that had been remarked upon, he did not think it would interfere so much as a spring, but at any rate it was a case in which at present that had no other successful method of treatment, and therefore he thought that when the cases were carefully examined they would come home to the Members with much greater interest.

Mr. E. Lloyd Williams said it was very evident that the Society did not take so much interest in mechanical as in surgical matters. [Cries of No!] Well, he thought that the want of animation with which the discussion was

being conducted was an evidence of the fact. He was about to remark that if anything approaching the ingenuity of the apparatus which had been shown, had been exhibited in connection with an appliance properly belonging to the domain of surgery, he felt confident that there would have been at least a dozen gentlemen prepared to speak at once. He thought that they all had to thank Mr. Storer Bennett for attempting to overcome some of their difficulties—that he would entirely get over them he felt inclined to doubt—and he thought that in time Mr. Storer Bennett would be able to get some appliances of a more simple character. Mr. Hepburn had already mentioned the little adjusting stud marked D; unless altered, he (Mr. Lloyd Williams) did not think they would find many patients whose tongues would tolerate coming in contact with it. There was one other difficulty, viz., the adjustment of the clasps. When the clasp was *in situ* it would of necessity leave a space between it and the teeth, in which the food would lodge. He thought that this was a decided drawback, and if Mr. Storer Bennett could improve the arrangement so that some of the drawbacks could be done away with, the process would be of extreme value, but he thought that in any case the Society were much indebted to Mr. Storer Bennett for his ingenuity, and the able manner in which he had explained the method.

Mr. J. H. Badcock wished to ask Mr. Storer Bennett of what he made the little pins—whether of gold, or what? If of gold, he thought that would very quickly wear through. Another objection in his mind was that the bands clasping the teeth where they did, would be likely to induce decay. The proper place for the application of a band seemed to him to be round that portion of the tooth where the enamel was thickest.

Mr. Storer Bennett, in reply, said in reference to Mr. Weiss' remarks, he would observe that tartar might very readily be dissolved by placing the piece in a strong solution of hydrochloric acid. With regard to the bands becoming covered with tartar, he thought it would be obvious that they offered great facilities for cleaning. Mr. Carter asked

if any patients found difficulty in opening the bands; so far he had not found any patient who had experienced the difficulty, on the contrary, it was much more easy to remove a plate with a movable band than with a fixed one. With regard to the strength of the spring, it might be adjusted to any extent at the time the plate was being made by putting a longer or shorter spiral spring, or putting one of thicker or thinner wire. In the case of the locking bands, the spring was a small piece of flat gold made as thick or thin as the case required. Again, if it were absolutely necessary to vary the strength of the spring it could be done by removing the pin which ran through the brooch joint, and then changing the spring for one of the requisite strength. Mr. Hepburn drew attention to the possibility of the bite incapacitating one from using the plate with hinged teeth. Of course he (Mr. Bennett) did not pretend that they might be used in *all* cases; he only contended that they met with difficult cases for which this apparatus would sometimes offer a remedy—he did not for a moment contend that it was universally applicable. It was for the purpose of not interfering with the bite more than was absolutely necessary that he laid stress upon the fact that the pins should be as near the cervix of the tooth as possible. Mr. Hepburn drew attention to the particular stud in the illustration; he had it left exaggeratedly long in the plate purposely, partly with a view of preventing any such impression arising as had occurred to Mr. Hepburn, and partly because if cut off quite level it would have been impossible for him to unscrew it and show the mechanism, but of course in a finished case, it would be cut off level with the tube. In answer to Mr. Lloyd Williams respecting the space behind the clasps, he would like to ask him if he had ever seen an ordinary plate with an ordinary clasp exhibit a space behind it? If so, he did not think that these bands were any worse than those. These bands he (Mr. Bennett) contended were capable of being more accurately fitted to an under-cut or overhanging tooth than any ordinary band could be, but of course unless properly made a gap would exist. Mr. Badcock asked if the pins were made of gold.

Everything connected with the apparatus was made of gold. The question of the most proper position for placing the band should not, he thought, be discussed at this meeting. He begged to thank the members for the discussion which had taken place, but confessed that he should like to have heard the opinion of many others present. Before concluding, he would remark that the various parts of the mechanism were originally constructed in his own workroom, but recently they had been made by Mr. Baker, of 55, Great Marlborough Street, to whom he was much indebted for the care which had been exercised in carrying out his designs.

The PRESIDENT observed that if the discussion had flagged in any way it was not for want of interest. He was sure that they all hailed with gratitude anything that helped them over serious difficulties which occasionally arose when making artificial dentures.

Votes of Thanks.

The usual votes of thanks concluded the meeting.

The next meeting of the Odontological Society will be held at 40, Leicester Square, on Monday, December 5th, at 8 p.m. A Paper will be read by Dr. Sims Woodhead, "On Inflammation in Bone." Casual Communications:—Mr. A. W. Barrett, "Adhesion between Fangs of two upper Molar Teeth and extraction of both simultaneously;" Mr. Ackery, "A Case of Complete Loss of the Teeth from Dental Caries in a lad aged 16 years." The patient will be in attendance half an hour before the meeting.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING,

December 5th, 1892.

MR. J. H. MUMMERY, M.R.C.S., L.D.S.

PRESIDENT, IN THE CHAIR.

THE Minutes of last meeting having been read and confirmed,

Mr. HENRY WILLIAMS MESSENGER, L.D.S.I., Clairville, 47, Rosslyn Hill, Hampstead, N.W., was elected a Resident Member.

Messrs. G. W. BATEMAN and J. F. COLYER were appointed auditors.

Mr. J. J. ANDREW, having signed the Obligation Book, was formally admitted to the membership of the Society by the President.

The following nominations for Resident membership were read :—Mr. WILLIAM THOMAS TROLLOPE, L.D.S.Irel.; Mr. FREDERICK WALTER BARRETT, L.D.S.Eng.; Mr. ERNEST HENRY LEWIS BRIAULT, L.D.S.Eng.

The PRESIDENT said that it was his painful duty to again have to record the death, since their last meeting, of a

former member of the Society, viz., Mr. Henry Moon, who took a great interest in the Society for many years, and was, he believed, for three years Vice-president. He was sure that the members would hear of his death with great regret.

The Librarian (Mr. Ashley Gibbings) reported the receipt of a parcel of books which had been kindly presented by Dr. Dudley Buxton, including :—"Compendium of Practical Dentistry," by B. Catching; "Deformities of the Mouth," 3rd edition, by Oakley Coles; "Aide Memoire du Chirurgien-dentiste, 1ere partie, Thérapeutique de la Carie dentaire," 2ème edition; "System of Oral Surgery," by James E. Garretson; "Dental Chemistry and Metallurgy," by Clifford Mitchell; "Medical Digest," 2nd edition, by Dr. R. Neale; "Index to the Periodical Literature of Dental Science and Art, as presented in the English Language," by J. Taft; "System of Dental Surgery," 2nd edition, by J. and C. S. Tomes. He also reported that "Practical Pathology," by Dr. Sims Woodhead, had been added to the Library, also the numbers for 1892 of the *Journal of Pathology and Bacteriology* edited by the same author.

The Curator (Mr. Storer Bennett), announced the receipt of a first left upper molar, having the sac of an abscess in the fork between the fangs, instead of in the usual position at the apex of one of them. The specimen was presented to the Society by Mr. Oswald Fergus, of Glasgow. Mr. Bennett showed also a specimen of gemmation of an upper temporary central incisor and a supplemental tooth, which was presented to the Museum by Mr. Montague F. Hopson.

Mr. W. Bowman Macleod said that as he was coming to London he had taken the opportunity of bringing with him a specimen of a skull which belonged to Dr. Johnson Symington of Edinburgh, who had exhibited it at one of the recent meetings in that city, and he (Mr. Macleod) thought it would be of value to the Society. The point of

interest in the skull was, not the rarity but the extraordinary number of ordinary irregularities which the teeth exhibited. On the left side a temporary canine might still be seen standing; then there was a bicuspid inverted and the eye tooth behind it; the first and second molars were irregular, and in a crypt behind them the wisdom tooth presented the coronal surface to the posterior part of the mouth. He was sorry to say that in transit the wisdom tooth had dropped out of the crypt, but they might take his word that it was originally there. On the right side the same condition of things existed, the coronal surfaces pointing backwards. There was no evidence of a wisdom tooth on the right side, but on shaking the skull one could hear that there was a loose body either in the crypt or in the antrum. Further, having heard that some gemmated teeth were to be presented, he thought that he might bring a few to bear them company. These teeth, he said, spoke for themselves, and there was no necessity for any special explanation. They included an upper molar gemmated with the second molar, also two lower molars in the same condition.

The PRESIDENT remarked that the skull was of very great interest, and he should be glad if they might photograph it.

Mr. G. BRUNTON suggested that a cast might be taken of it.

Mr. BOWMAN MACLEOD said that he would be happy to leave the skull in the care of the Curator, and in the meanwhile would communicate with Dr. Symington, who, he was sure, would readily give his permission.

Mr. ACKERY showed a patient, a lad of 16 years, who had lost the crowns of all his teeth from caries. He said he was sorry he had been unable to obtain a very perfect history, but so far as his investigations went, there was no suspicion of syphilis, rickets or struma. The lad was the seventh of a family of nine, all the others being healthy. He was healthy at birth (though his mother was very ill

prior to that event), and remained so until he was ten months old, when he had a severe attack of bronchitis, the doctor who attended him saying that he would never be well for the rest of his life. From this time until he was 7 years old he constantly brought up his food as soon as it was taken. From 7 to 13 he was better, but since that time has been unable to swallow solid food, and at intervals for the last three years had attacks of dysphagia, being quite unable to swallow even fluids for twenty-four to thirty hours at a time. He did not cut any teeth until he was twelve months old, and they then came slowly. His permanent teeth were erupted at the usual time, but never appeared strong, and commenced to decay as soon as cut. He was in the hospital at Cambridge four years ago, suffering from anæmia and debility. He was admitted at St. Bartholomew's Hospital some four weeks back, said to be suffering with dysphagia, but he had no difficulty in swallowing during or since his stay. He was sent to the dental department and was fitted with a complete upper and lower set of teeth with springs, the only two apologies for teeth—a second lower left bicuspid and second lower left molar, which were only partially erupted and decayed so far as they were above the gum being removed, all the other roots being allowed to remain. Thinking from the boy's appearance that he might have some kidney mischief, his urine was examined, with the following negative result:—sp. gr. 1012; no albumen; no sugar; no deposits; slightly acid. The patient was anæmic, but in other respects well and very intelligent. His father has very strong teeth, and though his mother has suffered at times with hers, they are of average quality. Mr. Ackery said that so far as his own experience was concerned such entire decay was unique, and he could only attribute the fearful ravages of caries to gastric disturbance, and the possible eructation of gastric juice. Since the teeth had been fitted there was a marked improvement in the boy's health and appearance.

The President enquired whether all the roots were present.

Mr. Ackery said as far as he could judge all the roots of the teeth were present. He might say that he could get no history of rickets, and there was no evidence of any such condition about the boy's frame; he was looking better now than when he first saw him.

Mr. Walter Coffin asked what was the reaction of the saliva?

Mr. Paterson took it that there was no doubt in Mr. Ackery's mind as to the causation? The constant regurgitation of the gastric juice had passed through his mind.

Mr. Ackery, in reply to Mr. Coffin, said that he had not had many opportunities of seeing the lad under varying circumstances, but when he first saw him in the middle of the day, two or three hours after food had been taken, the condition of the saliva was a little acid, but nothing very marked. With regard to Mr. Paterson's remarks, he would not pledge himself, nor had he come to any very distinct conclusions as to the cause. He had thought that the bronchitis might have produced gastric disturbance, and probably the saliva might have been acid, or, as Mr. Paterson had suggested, there might have been the irritation set up by the gastric juice.

Mr. E. Lloyd Williams showed a specimen sent up by Mr. Rowney (Derby), somewhat similar in character to those exhibited by Mr. Macleod. The mass, which came away in the attempt to extract one of the teeth, included the second bicuspid, first molar, and second molar of the upper jaw (left), and was firmly held together by the alveolus, which was necrosed, whilst the posterior buccal and palatine roots of the first molar were fused to the anterior buccal of the second molar. One point of interest which was noted, was the somewhat rare occurrence of *cementosis*, causing the absorption and actual perforation of the alveolar plate. The roots of a lower molar were also shown from the mouth of the same patient—a gouty clergyman 58 years of age—demonstrating the tendency to cemental deposit.

On Inflammation in Bone.

By Dr. German Sims Woodhead, F.R.C.P.Ed., F.R.S.E.

Director of the Laboratory of the Royal College of Physicians (Lond.) and Surgeons (Eng.).

With our present knowledge of the intimate structure of bone, and of the processes involved in inflammation of that issue, it is scarcely necessary to point out that here, as in all other tissues, the main processes have a uniform type; the reaction of the cellular elements are the same; the changes in the walls of the blood vessels are identical, and lead to secondary changes of much the same kind as those met with in other tissues. The fact, however, must not be lost sight of, that in bone the proportion of dead or devitalised material to active living cellular tissue is much greater than elsewhere, and that, therefore, the effects of inflammation are more evident to superficial examination—both clinically and pathologically—than when any other organ or part is affected. Moreover, in consequence of the large quantity of dead matter formed by the cells in health, there are much greater possibilities in the way of modification of structure under different inflammatory conditions than when any other part or tissue of

the body is affected. The bone derives its nutrition from two sets of vessels—(1) the large nutrient arteries, which, passing through small canals with hard and undistensible walls, supply the bone marrow and the layers of bone near the central or medullary canal; (2) the vessels breaking up into a network in the deeper layers of the periosteum, which afford a rich supply to the outer layers.

It is evident that we have areas of inflammation presided over by these two vascular supplies, perfectly independent of one another, and according as one or other area is affected—and how—we have clinical and pathological manifestations which can only be brought into line, and be looked upon as the result of the same processes of inflammation by a thorough study of the essential changes involved.

In order that we may approach the subject from the point of view that the main phenomena in inflammation are the result of the reaction of the tissue cells to an abormal stimulus, I will very briefly point out what an important part the cell plays in the process of bone formation. Taking first the bone of an epiphysis, just at the margin of the intermediary cartilage, and examining the homogeneous trabeculæ, we find that on them lie a number of small nucleated cells—the osteoblasts or bone-forming corpuscles. In the spaces

between the trabeculæ are delicate blood-vessels, the walls of which are also formed of, and surrounded by, small nucleated cells. In very early stages of bone-formation these cellular elements preponderate very largely, but as development advances they appear to form a delicate substance which ultimately takes the form of a homogenous matrix; then the cartilage disappears, giving way to a more fibrous matrix, which must be looked upon as forming the temporary scaffolding of the bony trabeculæ. The cells always remain, but the cartilage may be formed into or replaced by the more permanent bony trabeculæ. In addition to these small cells, both in cartilage and in bone, there are large multinucleated cells, which appear to have a special function in connection with the absorption of bone even under normal conditions—cells which are very similar to the plasmodia or large absorbing cells met with, especially in certain chronic forms of inflammation.

The periosteum, as we have seen, forms a vascular fibro-cellular sheath around the bone, and plays a most important part in determining the nutrition of the bone. The dense fibrous outer layer serves rather as a protecting sheath to the more vascular layer beneath the osteogenetic layer; this latter is composed of nucleated cells arranged in a fibrous matrix richly sup-

plied with blood-vessels. The cells, like those at the end of the bone, are somewhat modified both as regards shape and arrangement as they come near the bone, for whilst those near the surface are rounded and comparatively small, those nearer the bone are much larger and, often, spindle shaped. It is sometimes difficult to make out any sharp line of demarcation between the fibrillated matrix and the bone substance. Under normal conditions, then, whilst the small round cells in the situations above mentioned probably play a part in forming the matrix substance, the larger multinucleated cells appear to be more intimately associated with the destruction of the bone. We find, however, that in inflammation of bone where the small cells are more numerous, apparently as the result of rapid emigration of leucocytes or actual proliferation of these fixed cells, instead of laying down a matrix, they acquire a distinct power of absorbing the bone trabeculæ; however, of that more immediately.

For long it was held, especially by the German school of pathologists, that inflammation was associated almost entirely with the changes that occur in the walls of the blood-vessels, but the French school, who made a special study of the changes that take place in inflamed serous membranes, confined their attention almost exclusively to the epithelial and connective tissue

changes that are so marked in that position. When, however, we come to look at inflammation in its broadest aspect, and examine the processes as observed in the kidney, the liver, or in bone or cartilage, it is borne in on us that it is not associated with any single set of tissues, for we know that the walls of the blood-vessels, the lymphatic and connective tissue systems that surround the vessels, the cells lining large serous sacs, the parenchymatous cells of the various organs, the cells lining the alveoli or the bronchial tubes of the lung, the various layers of the periosteum, and the tissues within the bone, may any or all of them be involved; in fact, although one set of tissues in any organ may be affected more than another, we never find any manifestation of reaction in the one without obtaining certain evidence of a corresponding reaction in the others.

We now know that inflammatory changes may occur as the result of some noxious stimulus in a tissue entirely devoid of ordinary blood-vessels, just as certainly as it may occur in tissues in which we can find no epithelial cells, but we also know that if either of these structures be present in an organ or part subject to irritation, it will as a matter of course take part in the general inflammatory process. In no tissue does this hold good more completely than in bone, in which,

however, in acute inflammation as the result of injury, followed by the invasion of a pus-forming organism, the changes take place so rapidly that in most cases it is almost impossible to follow their evolution. Where a less acute inflammation is brought about by irritants that act rather more slowly, it is often possible to make out that the large endothelial cells forming the walls of the vessels undergo marked change; they swell up somewhat irregularly, their protoplasm, at first granular, ultimately becomes more hyaline in appearance than normal, and we have evidence of their division. Similar changes take place in the large endothelial cells lying in the perivascular spaces immediately around, and the other fixed connective tissue cells follow suit; moreover it may be observed that the branched cells lying in the lacunæ take on a similar granular and then hyaline appearance; at the same time there appears to be an escape, not only of fluid—which is rapidly absorbed by the altered cells and fibrous filaments, both of which may become enormously swollen—but of a considerable number of leucocytes which pass directly from the blood vessels into the surrounding lymph spaces. These changes can as a rule only be observed at the point of junction between bone and cartilage, where, as the calcification is more or less incomplete, it is possible to carry the knife through a

few spicules of bone near the margin of the cartilage, and then only in specimens in which the fixing process has been brought about very rapidly. In the leucocytes and in the proliferated fixed cells—which not only become very like ordinary embryonic cells or leucocytes in form, but also appear to revert, as regards their function, to the more primitive form of cell—we have evidence, both that they are more motile and more plastic, and that consequently they can make their way through comparatively small channels and spaces, whilst their voracity or power of ingesting foreign or dead particles is increased to an enormous extent. Unlike the normal osteoblasts, which they appear most to resemble, they may often be seen attacking, as it were, the formed fibrous, cartilaginous or bony matrix, and some observers have actually described the presence of minute, highly refractile, probably calcareous granules, in the substance of these cells.

Many authors ascribe the dilatation of bone spaces into large cavities to the mere mechanical distension caused by the accumulation of pus, but from what we know of the structure of bone it can scarcely be conceived that such dilatation, especially in the early stages of pus formation, is possible, unless the migratory and fixed connective cells, of which we have already spoken, have the power of gradually absorbing

the trabeculæ. That there is increased tension in the cavity within the bone is well known—in fact, just as in abscesses in the soft parts the tension is often extremely great. There are many people who still believe that this tension within the abscess cavity is due entirely to the altered vascular conditions maintained there; but how, may we ask, could any possible vascular changes increase the tension, and to what extent?

Allowing that the blood pressure in the capillaries under normal conditions is equal to a manometric pressure of two inches of water, one can understand that if there were extreme dilatation and weakening of the walls this pressure might be increased some twice or thrice, but such a pressure as this would be quite insufficient to raise the pressure to that obtained within an ordinary abscess, as anyone who has plunged a Syme's knife into a large abscess will have observed. Another purely physical factor, osmosis or dialysis, must be taken into consideration, and it has been suggested that the wall of an abscess practically plays the part of a dialysing membrane, and that in consequence of the difference in composition between the dead fluids within the membrane and the living ones outside we have a process of osmosis as a result of which the pressure within the abscess is at first raised, and afterwards, if the abscess be not opened, dimin-

ished. Here again the purely physical explanation is obviously not to be relied on, so that we are ultimately thrown back on one in which the chemico-physical and the "vital" factors are combined.

We know what happens in such a condition, say, as ulcerative endocarditis, when a septic embolism becomes lodged in a vessel. If the increase of fluids and leucocytes were due to the increased pressure—the *vis a tergo*—we should find them around the vessel on one side of the embolus in much greater quantities than on the other, because on the side nearest the vein the pressure should be considerably lower than it is on the side near the artery, that is, if the altered tension were caused solely by the impaction of the embolus; instead of that, however, we find that the leucocytes are distributed comparatively equally all round the thrombus. Then, too, it is evident that the increase in the number of leucocytes in this position cannot be due merely to the diapedesis as a result of increased pressure within the vessels, nor at this stage would any mere difference in the specific gravity of the fluids of the part lead to such an equal drawing in of leucocytes into a well circumscribed and limited area, the tissues and spaces of which can still be made out fairly distinctly between the crowding in leucocytes; for we have

an enormous accumulation of leucocytes in the site of what must ultimately become an abscess, although the tissues of which it is composed have not as yet become completely softened.

It is at this point that we have offered to us the explanation of chemotaxis. This chemotaxis, of which so much has recently been written, must be looked upon as the result of an effort made on the part not only of the leucocytes, but also of the rapidly proliferating fixed connective tissue cells to get rid of invading micro-organisms and their products. Whatever other factors may be pressed into service to help in the destruction of micro-organisms, these wandering cells, stimulated by a dilute poison, become more motile and assume a greater power of taking in foreign particles, although ultimately, as we shall see, they may become over-worked and may undergo rapid degenerative changes. Around any centre of pyogenic micro-organisms we find that there is a process which can only be compared to that brought about when enzymes act on albuminoid substances; we have both highly organised cells and connective tissues of various types undergoing regular digestion. The degenerating or digested materials, or chemical irritants, so formed, along with the enzymes themselves, act as foreign bodies; and it will be found that around and gradually invading the

degenerated mass are numerous small nucleated cells, most of which appear to have come from the blood-vessels, though, as one would expect, a certain number have arrived specially by the lymphatics; along with these are seen a number of larger cells which apparently can only have their origin in the fixed connective tissues cells —those endothelial cells lining the lymph spaces around the vessels. There appears to be, in fact, a definite attraction for these cells by the products of these micro-organisms acting on the proteids of the tissues—*a vis a fronte*—and we cannot but feel, on examining this process most carefully, that the increased tension must in great measure be due to this chemotactic action. Although in the centre of every abscess—the result of a specific inflammation—there is well marked degeneration of the tissues, there is always around this a cellular zone, similar to that we have mentioned, the cells of which appear to have an extraordinary power of devouring all dead or partially devitalised material, and even of taking up such organisms as have exhausted themselves in their attacks on the dead tissues, these devouring cells appearing to have little or no power of discrimination, for we find that just as in the case of formed connective tissues—or as Redfern pointed out, in the case of cartilage—so in bone we have these active cells

rapidly disintegrating the formed bony matrix, first appearing to remove the lime salts and then making short work of the matrix itself, and anyone who watches the absorption of bone carefully, will be able to make out the irregularly eroded outline against which the cells are directing their attacks, with a clear band immediately in contact with the cells, and beyond this the opaque tissue in which the calcareous salts still remain.

In a commencing abscess in a long bone in a case of osteomyelitis, one is able to see how perfectly are reproduced all those appearances that have been so frequently described in ordinary abscesses, and it is at once seen that acute inflammation in bone is essentially the same process and is attended with similar results as is acute inflammation in the soft tissues. The naked eye appearances and the clinical results are different and often are much more serious than when certain of the soft parts are affected, but this is due rather to the inability of the surgeon to reach the mischief without opening up channels through which the infection may be rapidly spread to other parts of the body than to any essential difference in the process itself. If we bear in mind the intimate relation of the periosteum to the nutrition of the outer shell of bone, we can readily understand

how any disturbance of the vascular arrangement in the periosteum, brought about by inflammatory changes, can interfere most seriously with the nutrition of bone, and that if the effusion of fluid and the accumulation of wandering leucocytes between the periosteum and the bone be large in quantity and extending over a considerable surface, how readily the bone may ultimately be cut off from its source of nutrition; the organised cells in the lacunæ and Haversian canals dying off and a mere shell of dead bone remaining.

The large spaces which are found in bone in acute inflammation, in which suppuration has not taken place or has not continued, only afford one of the forms of evidence of inflammation, but they always point to the fact that the inflammation has been comparatively acute, except in old people, when they point to a simple excess of the process of absorption over that of bone formation. Most of us, however, in our pathological studies have come across bones in which in place of a diminution in the quantity of calcified matrix, there has been apparently a filling up of the normal spaces and the production of a hard dense bone, to which the term osteo-sclerosis as opposed to osteo-porosis has been applied.

In connection with this, let me for a moment draw your attention to the peculiar solid wedge

shaped infarcts found near the ends of tuberculous bones: König, Alexis Thomson, and Watson Cheyne have all studied these indurated patches, and as they are perfectly definitely localised, they may here be studied more carefully than in other conditions where there is a general solidification of the bone. They occur most frequently at the ends of long bones near the junction of the epiphyses or immediately under the articular cartilage. König, who probably was the first to study them systematically, describes them as due to infarction, their wedge shape being due to the cutting off of the arterial blood supply to the small wedge shaped area, just as in the case of an infarction of the spleen. Thomson and others have raised objections to this explanation, holding that such masses are far more likely to be tubercular sequestra. As I have elsewhere pointed out, both processes probably enter into the causation of these pale hard masses. Klein, Watson Cheyne, and others, as a result of experiments have found that owing to the tuberculous changes in and around the vessels in the bone, there may actually be formed an infarcted area, but that in some cases there is no evidence of any primary tubercular process beyond the infarction itself; a probable explanation—whether these be due to localised

tuberculosis or not, though it can best be explained on the tuberculosis theory—is that the osteoblasts and other cells first proliferate as the result of slight irritation, and then, in consequence of further stimulation die *in situ;* they then, as in other positions, become swollen and hyaline and rapidly become infiltrated by lime salts. The infarcted bone assumes a much denser appearance than the normal bone surrounding it. The tendency to calcification in degenerated areas, which is so marked wherever there is slow degeneration in any tissue, s still more marked when such degeneration is going on in the cells in the bone canals. This explanation is somewhat different from that offered by Metschnikoff, although his observations, I believe, confirm in a most remarkable manner what I have stated. In the tissues of the Gerbilla, a small Algerian rodent, there is a distinct resistance to the action of the tubercle bacillus, a resistance with which a very beautiful process of calcification is said to have a causal relationship, but which I think is rather the result of a certain resistance.

Metschnikoff, who on this point disagrees with Weigert and Koch, holds that in such a giant cell we have no degeneration, but I believe from what I have seen in tubercle of the horse and the cow, in which calcification occurs at a very

early period, that we must look on the calcification itself as evidence of degeneration. We can scarcely imagine that the tubercle bacillus can go on forming a fresh membrane within the old membranes, and distending these latter after they have become calcified, but one can readily understand how the tubercle bacillus, acting on the protoplasm of the cells in its immediate neighbourhood, deprives it of its vitality and converts it into what, to all intents and purposes is a dead membrane through which however dialysis may take place, and in which the lime salts may be readily deposited: these membranes one would say are far more probably formed outside the old layers as successive dead layers are produced, each one offering a temporary protection for the living protoplasm against the action of the bacillus. As these layers become increased in number, the bacillus cut off from its food supply, a free exchange of nutrient material and effete products no longer being carried on by dialysis, the organism dies, the process of membrane, dead tissue, or degenerated tissue formation stops, and calcification becomes complete. Wherever this has taken place, as Metschnikoff has pointed out, it is impossible to make out by any staining reactions at our command, any trace of living bacillary protoplasm in the centre. We have in this a

very beautiful explanation of certain of the facts connected with tubercular inflammation in bone; first of all of the extraordinary density of the infarcted tuberculous areas, the "keil sequestra" of König, and also of the remarkable absence from these tuberculous foci of any tubercle bacilli that can be stained. We do not find the regular layers as described in the Gerbilla, because in these dense tubercular areas the tubercle bacillus in the first instance cannot diffuse its poison so equally, although in all probability it is enabled to do it much more rapidly; the results, however, are the same. A number of bacilli making their way into the spaces of a certain area are attacked by leucocytes and proliferating connective tissue cells, which we have seen soon become hyaline and swollen, and ultimately die; the bacilli confined along with the cells in the bone spaces may live for a time, there is always a slow dialysis going on to and from them, even through dead cells, and we have a deposition of lime salts, at first most markedly in the immediate neighbourhood of the bacilli, but ultimately in all the degenerating cells. As long as any channel by which fluid can arrive is left, the bacilli, although slowly degenerating, do not die, and we know that where this slow death takes place the bacilli will no longer take up the characteristic stains,

so that when we come to examine this dense bony mass no bacilli can be made out. It is often found that at the margin of the sequestrum a more acute process of inflammation has taken place, in which the process of proliferation and degeneration of the cells are so well adjusted that the phagocytes are enabled to open out very considerable spaces, in consequence of which the dense sequestrum may lie perfectly loose near the end of the long bone. The process of osteo-sclerosis — a somewhat clumsy term, but one which indicates the kind of process which takes place in very chronic forms of syphilis and in certain other diseases— may also be explained on this irritative inflammatory and degenerative theory, and it is one which I think is well worth further study.

In examining this process of calcification in chronic inflammation we must always bear in mind that we have a mass of active cellular elements with which the blood and lymph are constantly coming in contact; the fluids are the carriers from which the cells obtain their nutrient material; they are the vehicles by which effete matter is removed, and as a matter of fact it has been found that in the neighbourhood of all active cells these fluids differ very markedly in their composition from the general fluids. For example, there is always an increase in the amount of free

carbonic acid in the fluid near these cells, and we have a formation of phosphate and carbonate of lime, the latter in comparatively small amount. In the neighbourhood of dead membranes, if these salts are removed at once by dialysis, they remain stable and may be deposited at once, but if they are allowed to remain in contact with the phosphoric acid of the blood and the alkaline phosphates, they are re-dissolved, and are returned to the general fluid circulation. As Irvine and I pointed out elsewhere,* this primarily bears on the process of calcification of bone. The osteoblasts lay down a matrix of formed material; the more active the cells within certain limits the greater the relative amount of matrix. This matrix may be looked upon as inert or dead organic matter, which "corresponds to a membrane through which dialysis may take place, or rather the layers near the two surfaces may be so considered, and as the molecular combinations of the phosphoric acid and lime and the carbonic acid and lime takes place around the osteoblasts (which, as above stated, during their active formative changes give off the carbonic acid to render the lime for the time insoluble), there is a continuous process by dialysis of separation of

* Laboratory Reports of the Royal College of Physicians of Edinburgh, vol. ii., 1890, p. 142.

these lime salts, which first make their appearance in the centre of the matrix trabeculæ where the two currents meet, as it were; from this point the calcification extends towards the surface. We look upon the formed matrix, then (or dead material), as playing the part of a dialysing membrane that serves to separate the lime salts prepared in its immediate neighbourhood by the carbonic acid-forming cells, this carbonic acid causing a throwing down of phosphates of lime, with a small proportion of lime in which the phosphoric acid is usually replaced by carbonic acid. It should be observed in this connection that the carbonic acid is, when acting on the lime solution, in a nascent condition, and therefore in a much better position to combine with any lime already held by the phosphoric acid."

I am anxious to obtain some of those tuberculous sequestra, as I believe that an analysis of their composition will give us further proof of what I have here stated. As we know, newly-formed bones or new bone tissue of any kind, where the cells are extremely active in building up the matrix, almost invariably have a larger proportion of carbonate of lime than in fully formed bones, because here the active cells set free a larger proportion of nascent carbonic acid, as a result of which more phosphoric acid may be replaced by the carbonic acid lime salts; this may

be observed in a growing bone, in callus, in exostoses, and in irregular bone formation generally. On the other hand, when the process of bone formation is complete, or when it is interfered with in any way, there is always a tendency to the more ready removal of the phosphate of lime on account of its greater solubility, and we therefore find in the bones of old people that although there is a slight excess of phosphoric acid in the fluids and tissues, the carbonic acid not being so readily given off by the less active cells, the proportion of carbonate to phosphate in the bone still remains high.

The three elements necessary, then, for calcification are (1) devitalised tissue in which we have albuminoid matter; (2) a layer of formed material, such as fibrous tissue or some membrane (in bone both these are represented by the matrix, the fibrous tissue which in the centre of one of the trabeculæ is practically deprived of cells, the layer near the surface being merely a membrane in which a few cells still remain), and (3) we have the layer of proliferating cells always found in the region of any foreign or dead mass, these cells being the osteoblasts of bony tissues, and amongst their functions as regards calcification perhaps the most important is the generation of carbonic acid.

We may take it, then, that in all inflammations

of bone the ultimate changes depend upon the character of the inflammation through the action of certain irritants on the cells, and these vary in the effects they produce, first, according to the intensity and nature of the irritant, and secondly, on the strength or power of resistance of the tissues or cells on which the irritant acts. In acute inflammations, for example, such as those induced by the action of the Staphylococcus pyogenes aureus, or, as it was at one time termed, the micrococcus of osteomyelitis, (other organisms may produce the same effect on injured bone tissue) the process is always of an exceedingly acute character; there is rapid accumulation and stimulation of cells, and as we have seen, all the effects of abscess formation; death of certain of the cells; increased activity of others, in consequence of which not only bacteria and their products, dead cells, and the like, but also lime salts and bony trabeculæ, are gradually or rapidly devoured. In more chronic forms of inflammation we find that in place of this rapid digestion of the trabeculæ we may have an increased formation of bone, especially in those areas slightly removed from the irritative foci; there appears to be a very marked formation of irregular bony trabeculæ, and in these the deposition or calcification, though often irregular, may be extremely

well marked; whilst even in chronic specific inflammations certain of the cells undergo marked degenerative changes as the result of the irritant material secreted or excreted by the specific organisms, and in these dead cells a certain deposition of lime salts—a deposition which appears to account for the extreme density of bone in such diseases as chronic syphilis and tuberculosis—takes place.

Gentlemen, in treating a subject of this kind in a somewhat cursory fashion, it is difficult to avoid extremes; you will find in the text-books very little information on the pathology of bone inflammation, for the reason that pathologists do not insist sufficiently strongly that the ordinary processes of inflammation are here being reproduced, and that any differences observed are only of minor importance. Again, our knowledge of inflammation is undergoing such rapid modifications that we have scarcely time to apply what we know to the simplest processes of inflammation as studied in the readily accessible and easily prepared tissues, so that one is apt to get prosy over details both old and new. On the other hand, because our reasoning in bone inflammation is always from the general to the special, we are too frequently led to propound theories, some of which it is difficult to follow, unless we have the whole train of reasoning that has brought us

up to the point at which our theory is started. Much of what I have advanced may sound theoretical and may not be theoretically sound, but at any rate from facts I have observed it is so specious that it has recommended itself to me in the course of my work. Many points have still to be worked out, but on others we have already obtained much confirmation, often disconnected and sketchy, but still worthy of being fitted into a general scheme.

* * * * * *

Dr. Sims Woodhead's paper was illustrated by twenty-five photo-micrographic and other lantern slides.

Discussion.

The President, in opening the discussion, spoke of the great interest and valuable nature of Dr. Woodhead's paper.

Mr. H. Baldwin wished to ask how far proliferation accounted for the enormous number of cells? He thought that the latest teaching was that the cells were all migrated leucocytes, and that there was no proliferation at all until the activity of the inflammation had passed away, and then the original tissue-cells proliferated only with view to repair.

Mr. F. J. Bennett desired to ask whether Dr. Woodhead considered, in that portion of forming bone known as the calcified cartilage trabeculæ, the loss of nutrition in the intercellular substance, resulting from the swelling and disappearance of the cartilage cells, was the cause of the calcification of this intercellular substance, previous to its absorption?

Mr. C. S. Tomes said that it was rather difficult to discuss a paper such as that read on a short notice and without careful reading, but he should like to amplify Mr. Bennett's question, viz., was normal calcification to be regarded as deposition of calcareous matter in practically dead material as a matrix? There was one little difficulty which passed through his mind, that was, in one's knowledge of bone, and more especially of dentines, one always found that any dentine that was to last through a considerable part of the life of an animal was very freely penetrated by fine canals. Thus dentines which were less penetrated, with few vascular canals, and with no fine tubes, occurred in almost every instance in teeth which were cast off in a short time, and were constantly being replaced by new ones; so that it would seem that dentine which was to last any length of time must be penetrated with a copious tube system. That did not quite jump with the idea that all

the calcification was within a dead sort of tissue. Another point was, if the matrix of bone prior to, and after, the deposition of lime salts was practically dead tissue, one wondered at the intolerance shown by contiguous tissue towards absolutely necrosed bone. He seemed perhaps to be fighting the air, but he was giving utterance to what was passing through his mind while the paper was being read.

The PRESIDENT remarked that it struck him that this view of the deposit of calcified material might have some relation to the secondary deposits in the pulps of teeth which are the seat of some degenerative process.

Mr. ROUGHTON asked Dr. Woodhead whether he had observed the large multinucleated cells which he had demonstrated on the screen to take part in the formation of new blood-vessels? Dr. Woodhead had, he believed, described and figured a similar process in inflammation of soft parts. It was well known that in the vascular area of embryo chicks, the subcutaneous tissue of rats, &c., cells, precisely similar in appearance, developed into capillary blood-vessels. In a paper on "Blood Tumours of Bone" which Mr. Roughton had published in the *Transactions of the Royal Medical and Chirurgical Society* (vol. lxxiii.), he had suggested that the multinucleated cells of myeloid sarcoma developed into capillaries. He had since actually observed the process in sections of myeloid sarcoma of bone; he had seen the myeloid cells undergoing vacuolation, and developing, within their substance, spherical bodies which he thought were embryonic blood corpuscles.

Mr. W. HERN said there was one point in dental pathology which appeared to antagonise with Dr. Sims Woodhead's view of the deposition of bone salts in dead tissue, and which agreed with Mr. Charles Tomes's criticism. In the cementum of the roots of teeth, which is a body somewhat similar to bone, depositions of fresh calcified material frequently occurred, causing exostoses. The new deposit, however, always occurred on living portions of cementum, and never on dead portions. In cases of necrosis of the apices of roots, no fresh cementum

was ever deposited on the dead tissue, although it was frequently deposited on the living cementum around.

Mr. W. B. Paterson wished to join a question to that of Mr. Roughton's as to the giant cell or absorbing cell—how did Dr. Woodhead account for the development of the giant cell? Did he think it a leucocyte in the first instance? Did he think it grew at the expense of the tissue it ate, or did he think it a cell which had a connection in destroying tissue, not by absorbing and growing at its expense, but by secreting an acid? On the question of abscess tension he was somewhat mixed in his ideas of what had been said; as he followed Dr. Woodhead, he understood him to say that this tension was not mechanical, but he presumed that Dr. Woodhead was referring to it in some other way than that which they recognised as the tension which in all abscesses caused pain, and which did seem to be of a mechanical nature. He (Mr. Paterson) understood that the pus is dialysed through the cells of the abscess wall so-called, and makes towards the centre, if there be at the centre some foreign matter or irritant, *e.g.*, tubercle or embolus, or parasite. Might it not be equally possible for the dialysing or straining process to take place in the opposite direction under certain circumstances, and might not a serious danger thereby arise of septicæmia, unless the cells of the abscess wall offered a barrier of resistance to protect the system in some way?

Dr. Woodhead, in reply, said in answer to the question as to proliferation, he had at one time believed that the increase in the number of cells was entirely due to the passing in of leucocytes, and of course that was Cohnheim's teaching; but they must look upon the cells in any position—part of an inflamed area—as being irritated, and as they knew that with any irritation proliferation took place. He had tried to follow the history of these cells in various parts of an abscess, and although the leucocytes played perhaps the most important part in early stages, there was undoubtedly proliferation in connective tissue cells; they first of all lost their irregularity or their branching processes, the protoplasm of which seemed to be drawn in, and then, undoubtedly, a prolifera-

tion of these fixed cells took place. Of course, in the later stages it was now evident that the connective tissue cells played a most important part; they played the part not only of scavengers, but by them the new tissues were built up; but even in the initial stages they always found that the connective tissue cells by proliferation took part in forming some of the new cells at the point where the abscess occurred. These cells, of course, could not ordinarily be distinguished in the centre of the abscess, but at some little distance from the margin of the abscess area it was possible to distinguish them, and at the margin of the abscess one found the connective tissue cells and the fixed cells generally retaining many of their normal features. In the later stages they played a much more important part; they then took on the functions which were associated with repair; they assumed a regular form, and altogether overshadowed the leucocytes. As regarded the giant cells, he had been asked if he had seen them in connection with the formation of vessels in bone; he had not noticed this in bone, and it was an exceedingly interesting fact that Mr. Roughton had been able to demonstrate this in connection with sarcoma, and as having a special relation to the formation of vascular areas of the giant cells, he should very much like to see this. Then as regards Mr. Tomes's question in connection with the dead cells, he (Dr. Woodhead) looked upon the matrix perhaps not as dead but as practically devitalised and *passive* tissue; it was no longer tissue which played any *active* part in connection with the body. With regard to the question of the formation of cementum, he thought it was quite possible these cement canals, with their small protoplasmic processes still connected with the active cell, played a most important part in determining the process of deposition in dead bone, because one knew that in dead substances the quantity of decalcified material was exceedingly small. In order that it might be precipitated in a finer condition and therefore in a much denser condition, because in a large area and in connection with the large membrane around a large quantity of dead matter one always found it as coarse

calcareous particles; whilst in the cementum they had the lime salts deposited as the result of a slow separation by fine films of protoplasm, and precipitated in a fine organic membrane. These channels, with their contained processes, appeared to him to play an important part in conducting the lime salts away from the organic matter in which they could be held in solution. As regards giant cells, he looked upon these as cells in which, although the protoplasm did not break up into smaller cells, the nuclei divided sometimes pretty rapidly wherever one had a large area to be nourished rapidly and thoroughly, that is, where protoplasm had to take up nutrient material rapidly. It is also supposed that these plasmodia were more active in taking up and digesting foreign material than individual cells were. With regard to Mr. Paterson's question, he wished to say that the tension in an abscess was not brought about by any mechanical process. As regards dialysis also, he looked upon it as playing a comparatively unimportant part; it was not merely a question of dialysis, but of the cells coming from the outside towards the centre, and he therefore looked upon it as not merely a process of dialysis, but one involving something very much more. Then there was no doubt that the granulation tissue layer, the so-called pyogenic membrane at the margin of an abscess, did afford very great protection against the absorption of poisonous substances from an abscess, this being due to the fact that they were made up of a large number of cells which had not been acted upon by the poisonous material, and which still retained a power of transforming such material as reached them into comparatively innocuous substances.

Votes of Thanks.

The usual votes of thanks concluded the meeting.

The next meeting of the Odontological Society of Great Britain will be the Annual General Meeting, and will be held at 40, Leicester Square, W.C., on Monday, January 9th, 1893. The President will deliver his Valedictory Address, and the officers for 1893 will be balloted for and elected. Casual Communication:—Mr. Ackery, "A Peculiar Case of Bone in Dentine." A paper will be read by Mr. E. W. Roughton, F.R.C.S., "Micro-organisms of the Mouth," with lantern demonstrations.

Odontological Society of Great Britain.

ANNUAL GENERAL MEETING.

January 9th, 1893.

MR. J. H. MUMMERY, M.R.C.S., L.D.S.

PRESIDENT, IN THE CHAIR.

THE Minutes of the preceding meeting having been read and confirmed,

The PRESIDENT declared the ballot opened. Messrs. F. C. RILOT and PERCY SMITH were appointed scrutators.

Messrs. DAVID THOMSON and H. W. MESSENGER signed the Obligation Book, and were formally admitted to membership by the President.

Mr. HAROLD STONER, L.D.S.Eng., Tylney House, 110, Queen's Road, Brighton, was balloted for and elected a Non-resident Member.

Mr. ROBERT HEPBURN was proposed by the Council for Honorary Membership, and his election carried by acclamation.

The following were nominated before the Society:—CHARLES FRANCIS PEYTON BALY, L.D.S.Eng., 140, Harley Street, W. (resident); EDWARD JOHN BLAIN, L.D.S.Eng., 35, Moore Street, Chelsea (resident); THOMAS HERBERT CLARENCE, L.D.S.Eng., Chase Side, Enfield (resident); ERNEST GARDNER, L.D.S.Eng., 139, Victoria Street, W. (resident); SAVILE HENRY HAYWARD, L.D.S.Eng., 12, St. Anne's Terrace, Circus Road, St. John's Wood (resident); GEORGE NORTHCROFT, L.D.S.Eng., 4A, Portman Mansions, W. (resident); EDWARD JOHN PREEDY, L.D.S.Enn., 1, Hanover Square, W. (resident); EDWARD F. SMITH, L.D.S.

Eng., 176, Brixton Road, S.W. (resident); Herbert John Stevens, L.D.S.Eng., 72, Jenner Road, Stoke Newington (resident); Charles J. Tisdall, L.D.S.Eng., 2, Heathfield Road, Acton (resident); Douglas Phillimore Gabell, L.D.S.Eng., 47, East Street, Brighton (non-resident); William Henry Goodman, L.D.S.Eng., Palace Gate, Exeter (non-resident); Arthur Curling Hope, L.D.S. Eng., Rockholme, Hastings (non-resident); Hubert L. Curling Hope, L.R.C.P.Lond., M.R.C.S., L.D.S.Eng., Rockholme, Hastings (non-resident); Gavin Martin, L.D.S. Eng., 7, Manningham Lane, Bradford (non-resident); Ernest Weston, L.D.S.Eng., High Street, Ventnor, Isle of Wight (non-resident).

The Treasurer (Mr. Thos. Arnold Rogers) in presenting his Annual Report, said that as the Members would be aware, it was usual to prepare two balance sheets, one showing each item of receipt and expenditure, which did not convey very much information, and the other, which is specially subdivided under different heads, giving a fairly good idea of income and expenditure.

The Report was then read and passed.

The President spoke of the Report as most satisfactory, and said he felt that all the members would share his regret that it was the last one Mr. Rogers would present to them, as he felt compelled to resign his office.

The Librarian (Mr. Ashley Gibbings) stated he had since the last meeting received three antique books of interest from Mr. Alexander, and had acquired by purchase Professor Crookshank's "Manual on Bacteriology." He then proceeded to read his Annual Report.

He said: I have the pleasure to report, Mr. President, that during the year just passed, several books and papers have been presented to the Society, which I have duly acknowledged at the monthly meetings. We have also added a few books by purchase, among which I may mention three upon pathology and bacteriology—a subject in which many of us are specially interested at the present time—viz., "Practical Pathology," by Dr. Sims Woodhead;

"Manual of Bacteriology," by Professor Edgar Crookshank, and the numbers, for 1892, of the *Journal of Pathology and Bacteriology*. The number of members who have borrowed books is eighty-five—a slight increase over last year—and of students, nineteen. I would once again remind members of the importance of returning books, and especially new works, as soon as they have finished with them, that others may also have the opportunity of consulting them. The Library is open for the use of members one Wdnesday evenings from six to eight o'clock, and also on the night of our meetings, when the Journals and *Transactions* which have been received during the month are on the table. I append a list of the Societies and Journals with which we exchange *Transactions*, and of the Journals for which we subscribe. We exchange with the Royal Society of London, Royal Institution of Great Britain, Royal Dublin Society, Smithsonian Institute, *International Dental Journal*, *Guy's Hospital Reports*, *Journal of the British Dental Association*, *British Journal of Dental Science*, *Dental Record* and the German Odontological Society. We also present our *Transactions* to the Royal Medical and Chirurgical Society, Royal Microscopical Society, and the Medical Society of London, and we are at present in negotiation with these Societies for an exchange of *Transactions*. We subscribe for the *Lancet*, *Dental Review* (Chicago), *Journal of Anatomy and Physiology*, and *Journal of Pathology and Bacteriology*. In conclusion, I beg to remind members that there is a Suggestion Book on the library table, in which they may enter the name of any book which they desire to be purchased, for the consideration of the Council.

The Curator (Mr. Storer Bennett) said that having acknowledged and commented on the specimens at the time they were presented, there was nothing to add to his previous statements. As in former years, the additions to the Museum during the past session were placed on the table for inspection. Owing to the uncertainty of the Society's tenure of their present premises, the specimens had been temporarily stored away instead of being exhibited in their cases; but if any members wished to examine such

Odontological Society's Accounts for the Year November 1st, 1891, to October 31st, 1892.

Dr.	£	s.	d.
To Annual Subscriptions	437	16	6
,, Arrears	36	15	0
,, Entrance Fees	74	11	0
,, Sale of Transactions	4	10	11
,, Further Donation from the Ex-President, J. S. Hutchinson, Esq., towards the expenses of the Conversazione to the British Dental Association in 1891	22	10	0
	£576	3	5

Cr.		£	s.	d.	£	s.	d.
By Rent					150	0	0
,, Fire Insurance					2	10	6
,, Meetings.	White—Electric Fittings to illustrate Papers	4	11	0			
	Baker—Microscopes, &c., ,, ,,	2	12	6			
	Ellison—Reporter (Mr. C. Heath's Paper)	2	2	0			
	Bale—Notices, Postage, Stationery	8	13	7			
	Camps—Refreshments	28	10	0			
					46	9	1
,, Library.	Lewis—Books and Periodicals	5	9	10			
	Rutterford—"Cosmos"	0	12	0			
	Year Book of Societies	0	6	0			
	Hersant—Binding	3	4	0			
	Camps—Sub-Librarian	5	5	0			
					14	16	10
,, Museum.	Curator—Money disbursed	4	2	0			
	Shaw—Work done at Museum	14	4	1			
	Camps—Sundries	0	10	6			
					18	16	7
,, Transactions.	Bale & Sons	155	7	8			
	Sub-Editor	27	16	0			
	Past Presidents' Portraits	8	8	0			
	Barraud—Loan of Negatives	1	10	0			
					193	1	8
,, General.	Advertisements for New Premises	2	16	0			
	Bale—Notices, Lists of Council, Stationery, Postage, &c.	18	5	8			
	Curtiss—Writing Names of Presidents	0	7	6			
	Member's Subscription returned, having been paid twice	2	2	0			
	Treasurer's Postage	3	3	2			
	Secretary's Postage	2	10	0			
	Camps—Postage	0	16	0			
	Camps—Gratuity	5	5	0			
	Bank, Commission and Stamp	0	3	6			
					35	8	10
					£461	3	6

	£	s.	d.		£	s.	d.
Balance at Bank, October 31st, 1891	147	5	0	Gross Expenditure, November 1st, 1891, to October 31st, 1892 ..	461	3	6
Gross Receipts, November 1st, 1891, to October 31st, 1892	576	3	5	Balance at Bank, October 31st, 1892	262	4	11
	£723	8	5		£723	8	5

	£	s.	d.
Gross Receipts for the year, November 1st, 1891, to October 31st, 1892	576	3	5
Gross Expenditure ,, ,, ,, ,, ,, ,,	461	3	6
Surplus of Receipts over Expenditure	£114	19	11

INVESTMENT ACCOUNT.

	£	s.	d.
Amount in £2 15s.% Consols, October 31st, 1891	3,169	7	1
Dividends, January, April, July and October, 1892, £85 17s. 4d., invested, and producing	88	10	5
Amount in £2 15s.% Consols, October 31st, 1892	£3,257	17	6

EXAMINED AND FOUND CORRECT { G. W. BATEMAN. J. F. COLYER.

unexhibited specimens every facility would at all times be offered them. For the greater convenience of visitors to the Museum, some seats had been provided, and it was hoped they would be found a convenience to those studying the collection.

The Reports were then duly passed.

The PRESIDENT then called upon Mr. Ackery for his Casual Communication.

Mr. ACKERY said that it might be within the recollection of some of the Members that in March, 1891, he had shown an upper bicuspid tooth which he had extracted from the mouth of a medical man, about 33 years of age. The tooth, which presented caries in the crown, had partially erupted high up towards the outer side of the alveolus; when extracted the root appeared only about two-thirds formed, it being difficult to say whether the diminished size of the root was due to absorption or arrest in development. Mr. Ackery had at that time asked for an expression of opinion as to the cause, but no one present spoke on the subject. With a view to settling this question, Mr. Colyer had kindly made a microscopical examination of the tooth, and would report what he had found.

Mr. COLYER said that six sections of the tooth were obtained, four being transverse, the remaining two being cut vertically, so as to include the end of the root. These latter showed well-marked Howship's lacunæ, pointing to the fact that in all probability the loss of tissue of the root was due to absorption. The transverse sections showed that the dentine contained in its midst true bone. In the first, namely, that taken near the crown, two or three small canals were seen containing tissue exactly like bone. In the section taken just below this, a large portion of the dentine had been replaced by a tissue very irregular in character, but being at places of a distinctly osseous character. To the side of this, but yet separated from it, was another oval space containing distinct osseous tissue. In the third section these two spaces had fused together, and the first had progressed much further into the dentine. The tissue towards the pulp chamber still retained the irregular cha-

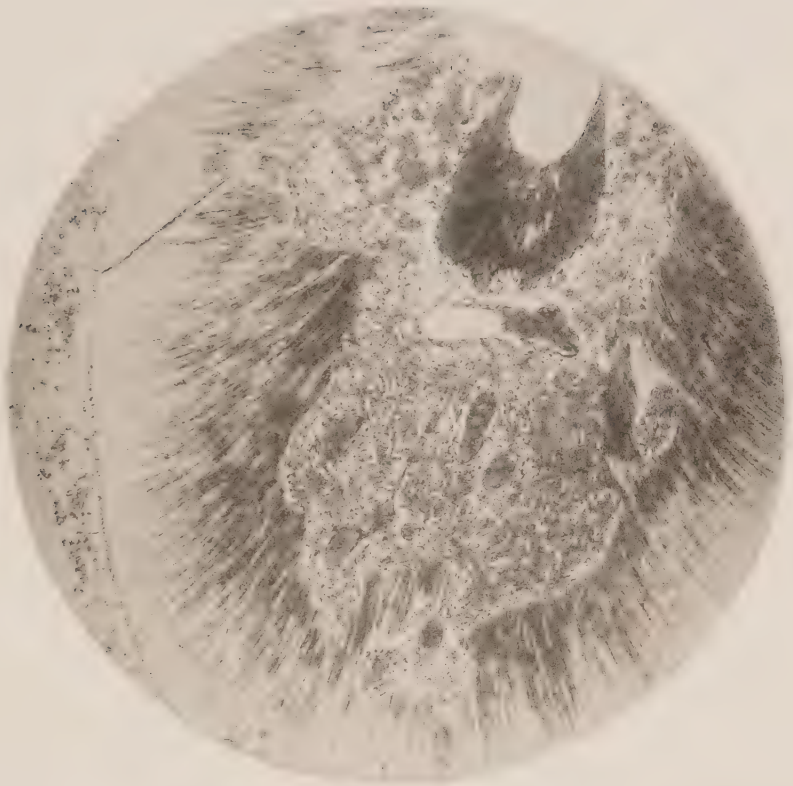

FIG. 1. Section near the base of the bicuspid tooth referred to in the text. The figure gives a general view of the extent of the new formation.

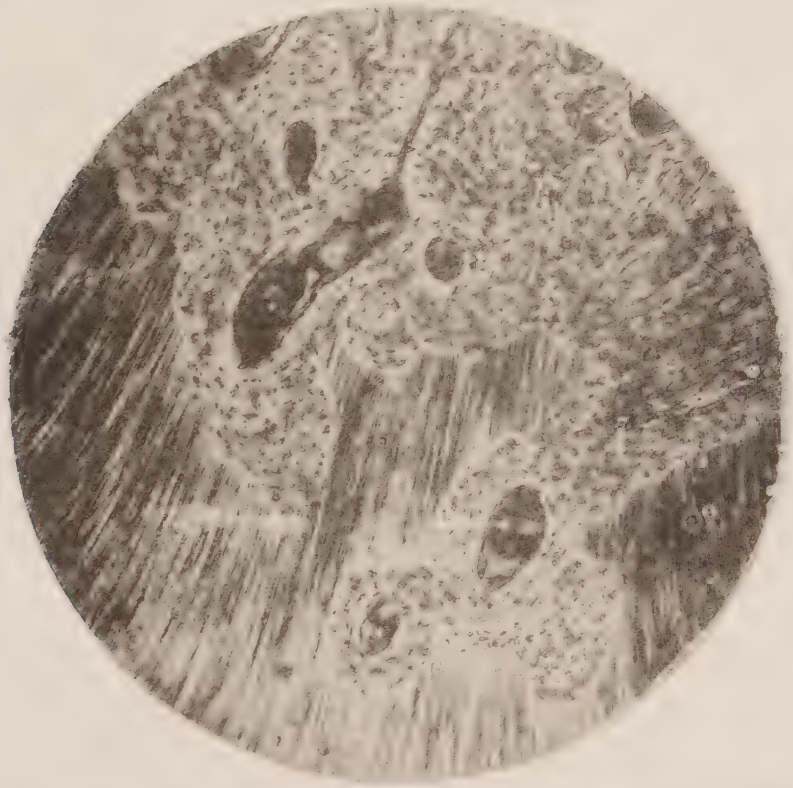

FIG. 2. A portion of Fig. 1 under a higher power, showing the distinctly osseous character of the new formation.

racter spoken of above, but in the portion most distant from the pulp there was distinct osseous tissue with well-marked Haversian systems. The next section, namely, the fourth, showed a still greater portion of the dentine replaced by true bone, the irregular tissue only being apparent on that part nearest to the pulp chamber.*

That the bone did not form part of the original structure of the tooth seemed, Mr. Colyer thought, probable. First, because the margin of it was distinctly cupped, or in other words, showed Howship's lacunæ, and again, in the fourth specimen, there were a few dentinal fibrils amongst the bone. It seemed, therefore, probable that the dentine had been absorbed and replaced by bone, the greatest changes taking place towards the base of the tooth.

The second specimen was taken from a lower wisdom tooth which was misplaced, so that no portion appeared above the gum. This tooth was treated by the Weil process, and showed, like the preceding one, absorption of the dentine and re-deposition of bone; but the latter was not so well formed as in the preceding specimen. In looking over the literature bearing upon the question of the presence of bone in dentine, or its occurrence in teeth as a new formation, Mr. Colyer had been unable to find an account of any specimens showing the condition so definitely as that shown in the accompanying illustrations.

Salter, on p. 70 (fig. 49) of his "Dental Surgery," figured a specimen, the character of which it was doubtful to be quite certain about from the drawing, but it certainly appeared more like a section containing a large number of pulp stones than Haversian systems, and the text referring to the specimen also seemed to point in the same direction, for Mr. Salter said: "Usually, however, there are many systems of secondary dentine surrounded by and adherent to the primary dentine, as seen in the accompanying illustration."

The only other reference to the subject was from Wedl, and in his "Pathology of the Teeth" he referred to the subject in the following words:—

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* Two lantern slides were shown, and the specimens themselves were exhibited under the microscope.

"I have met with a few cases only of true new formations of osseous substances within the parenchyma of the pulp. They occurred in the pulps of milk teeth which were undergoing resorption, and one of these cases is reported by Heider and Wedl. Upon the posterior surface of a milk incisor which was extracted there was a deeply-grooved breach of substance, about six millimetres in length, extending from the neck of the tooth towards the root, and the corresponding portion of the coronal and radial pulp was denuded. The contents of the nerve tubes of the latter had undergone a molecular degeneration, and the nerve tubes themselves presented in places a shrivelled appearance. Within the pulp, which was tinged with blood, a firm lamella was found united with the tissue of the pulp, about two millimetres in length and one millimetre in breadth. Upon very close examination of the structure it was found that the central, more compact portion, was ossified, while the marginal portion was composed of aggregations of minute calcareous grains. The lamella contained, as is the case generally with young osseous plates, several oval foramina for the transmission of blood vessels; very distinct bone corpuscles, which were in clusters, were furnished with short processes, and on the whole bore a strong resemblance to those of a young formation. The new formation of osseous substance in this case was due to the irritated condition of the pulp engendered by its exposure."

The PRESIDENT said that Mr. Ackery had kindly given him the opportunity of looking at the sections, and absorption cavities could be very plainly seen. There seemed to be true bone forming. He believed that Mr. Tomes, a good many years ago, contributed a paper to the Society on an abnormal condition of the teeth in a grampus; he (Mr. Mummery) had not had time to look it up, but he thought it was a case of occurrence of bone in dentine.

Mr. F. J. BENNETT considered that Mr. Colyer had scarcely done justice to Mr. Salter's specimen. There were really two figures of the specimen in Mr. Salter's book, one of them showing three small holes on the exterior of the tooth

just below the neck and passing into the pulp cavity. In addition to the testimony of so careful an observer as Mr. Salter as to the new formation being of true bone, Mr. Bennett considered that these canals pointed to the manner in which the growth had taken place, namely, by the passage of blood vessels and cells from the osteogenetic layer of the periosteum of the tooth, this granulation tissue both causing absorption of the walls of the pulp cavity and deposit of true bone in its place.

Mr. Storer Bennett said that being much interested in the specimen of bone in dentine described and figured by Mr. Salter, he had, in his official capacity, written to him some year or so ago, begging permission to examine and photograph the specimen; illness, however, had prevented the request being complied with, but he still hoped he might be able to obtain and exhibit the specimen in the future. He felt sure Mr. Salter intended to convey in the description his belief that the abnormal tissue was true bone, and *not* secondary dentine, the three foramina at the neck of the tooth being the means of communication between the adventitious tissue and the periosteum.

Mr. J. F. Colyer, without wishing to claim any credit for originating a theory, said that looking at the two drawings and reading the context he felt that the balance of evidence was in favour of the views he had expressed.

The President remarked that the engravings were somewhat coarsely executed, so that it was very difficult to feel very decided upon the matter, but they did not look quite like bone to him.

Mr. David Hepburn said :—At the last meeting of this Society, some interesting examples of cemental union between teeth were brought forward by Mr. McLeod and Mr. E. Lloyd-Williams. Since that meeting a remarkable specimen of this abnormality has come into my possession.

The specimen which I now beg to exhibit shows a mass representing two abnormal geminated teeth, which existed in the situation of the left upper second molar, while at the extremity of its posterior root, what appears to be a wisdom

tooth is horizontally placed and attached by dense osseous tissue.

The history is as follows. The patient, a gentleman aged 56 (who, it may be mentioned, exhibits marked attrition with pulp ossification of his remaining incisors, canines and bicuspids), some years ago discovered a growth protruding into the cheek at the posterior extremity of the left upper jaw. This causing some irritation, he consulted a dentist, who pronounced the growth to be a wisdom tooth erupting horizontally in an outward direction. Various dentists advised the extraction of this wisdom tooth, but the patient would never submit to the operation. Eventually the mass representing the second molar began to loosen, the external plate to absorb, and after some years the patient himself removed it, to his surprise bringing away also the portion which had been diagnosed as—and supposed to be—a separate wisdom tooth. A glance at the diagrammatic sketch (sketch exhibited) will explain the peculiar conditions of union, and in conclusion I would add that Mr. E. Lloyd-Williams, in referring to his case at the last meeting, said—" One point of interest was the somewhat rare occurrence of ' cementosis ' causing absorption and actual perforation of the alveolar plate." This case seems to bear upon this point, but I am inclined to think that odontomes, united teeth, and teeth greatly exostosed, frequently create perforation, more especially when necrosed; in this state they tend to assert themselves as foreign bodies, and so get thrown off by the surrounding tissues.

Mr. Spokes showed two lantern slides which he had made from sections prepared by the Weil method. The first was a vertical section through the upper jaw of an infant aged about six months. The temporary incisor was seen emerging from the gum, and the amount of development of the permanent incisor at this stage, calcifying in its bony crypt, could also be observed. The second slide illustrated a vertical section through the lower jaw of a monkey. Here the root of the temporary incisor was undergoing absorption, and the crown of the advancing permanent tooth was in close relationship with the exposed pulp of the temporary tooth.

THE MICRO-ORGANISMS OF THE MOUTH.

PLATE I.

FIG. 1.—Spirochœte dentium, from under a slightly reddened and inflamed gum. Magnified 900 diameters.

FIG. 2.—Leptothrix from the same specimen as fig. 1. Many threads are seen to spring from a common origin. Magnified 500 diameters.

PLATE I.

FIG. 1.

FIG. 2.

PLATE II.

FIG. 1.—Caries of dentine. The tubes are crowded with thread forms; the wall of a cavity is fringed with leptothrix. Magnified 750 diameters.

FIG. 2.—Caries of dentine; infection of tubes by bacilli and threads. Longitudinal section. Magnified 750 diameters.

PLATE II.

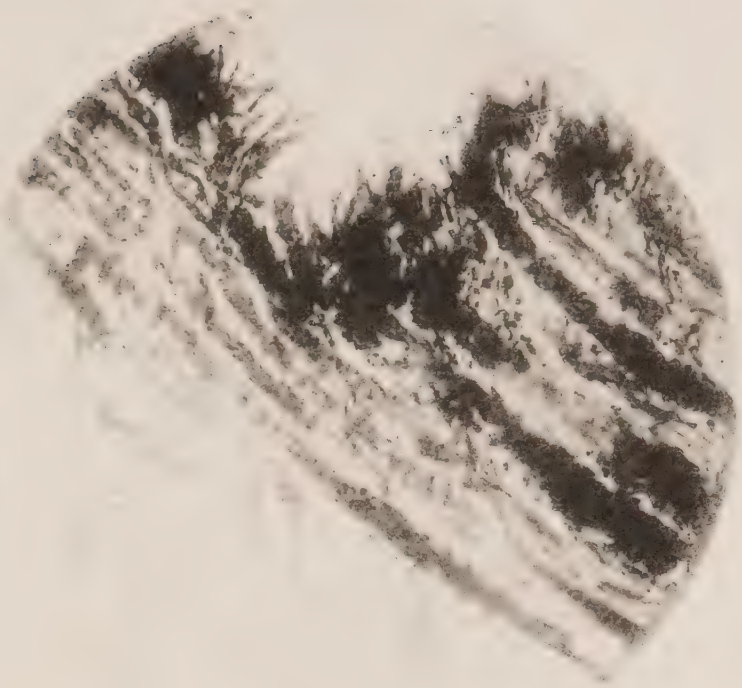


FIG. 1.

FIG. 2.

PLATE III.

FIG. 1.—Caries of dentine. Infection by micrococci; liquefaction foci. Longitudinal section. Magnified 500 diameters.

FIG. 2.—A similar specimen more highly magnified (900 diameters), showing the individual organisms.

PLATE III.

FIG. 1.

FIG. 2.

PLATE IV.

FIG. 1.—Caries of dentine, transverse section. Some of the tubes are empty, others are full of micro-organisms. Leptothrix between the tubes. Magnified 750 diameters.

FIG. 2.—Saccharomyces mycoderma. The thrush fungus. Magnified 500 diameters.

PLATE IV.

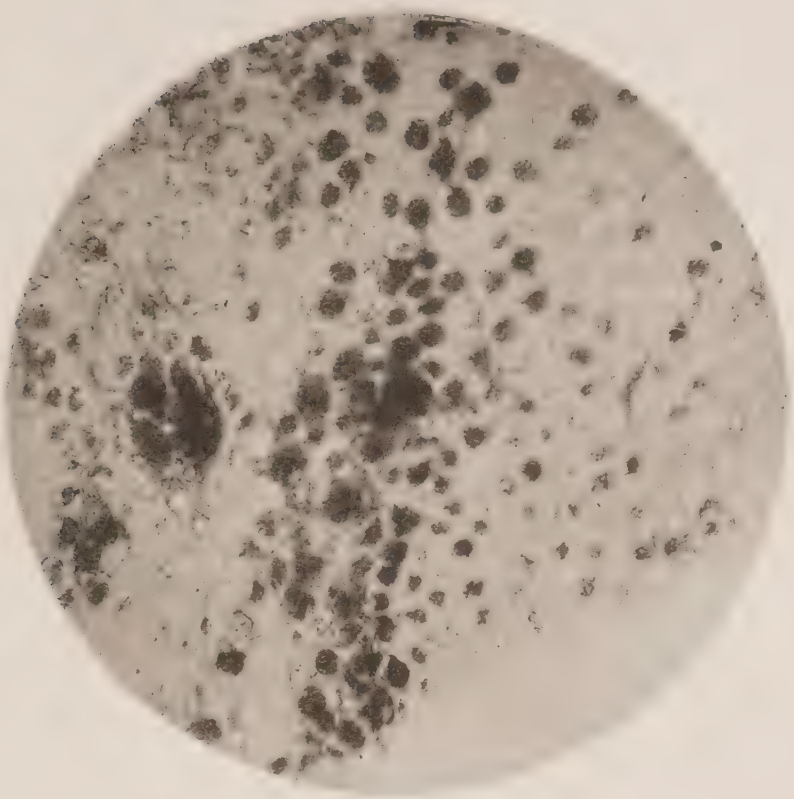


FIG. 1.

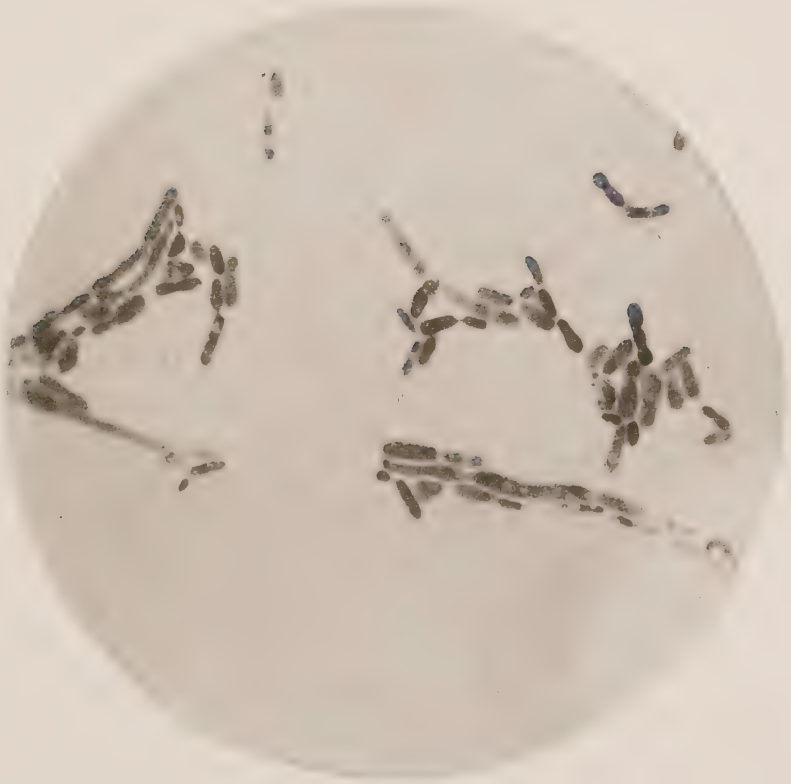


FIG. 2.

PLATE V.

FIG. 1.—Torula and staphylococci. Agar culture from antral pus. Magnified 750 diameters.

FIG. 2.—Bacillus buccalis septicus. Agar culture from the same case as fig. 1. Magnified 900 diameters.

FIG. 3.—Curved bacilli from the same case as fig. 1. Agar culture. Magnified 900 diameters.

FIG. 4.—Cover glass preparation of pus from the antrum; show encapsuled diplococcus. Magnified 900 diameters.

PLATE V.

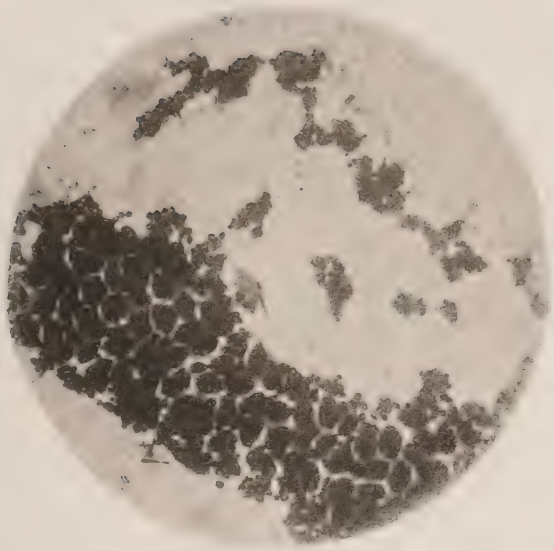


FIG. 1.

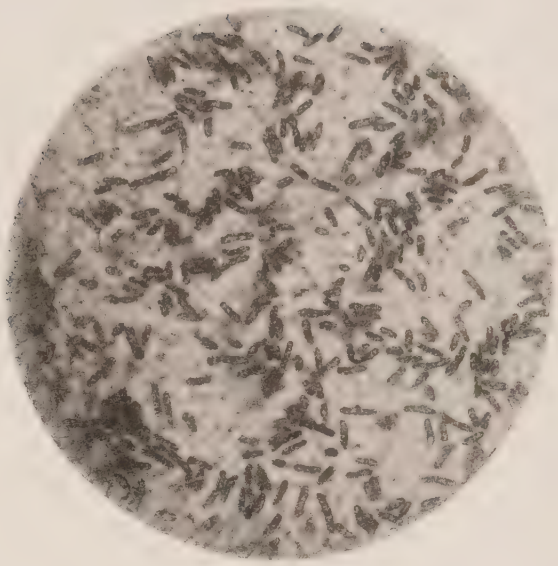


FIG. 2.

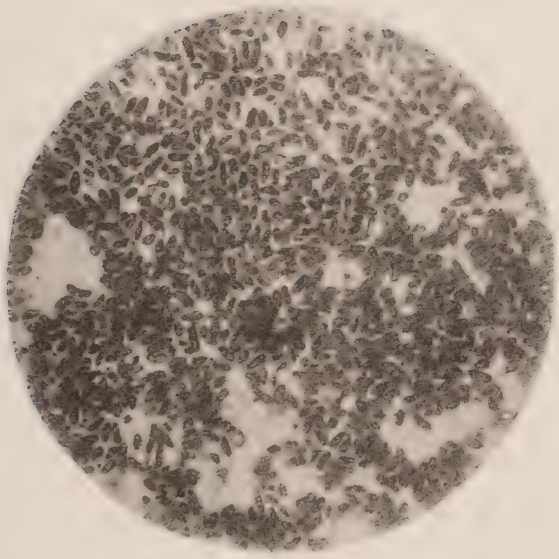


FIG. 3.

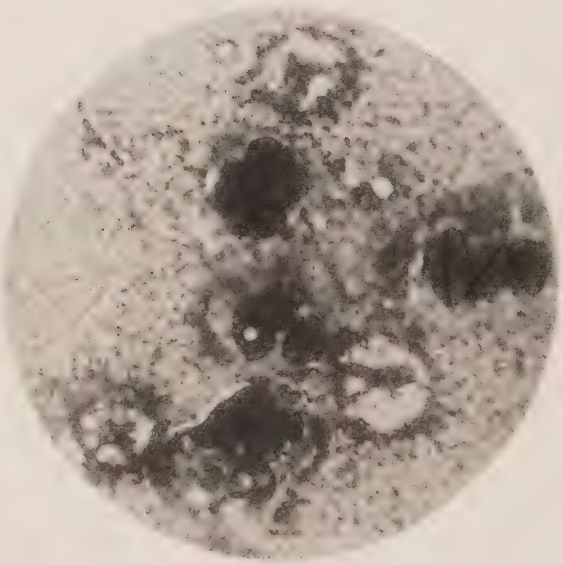


FIG. 4.

PLATE VI.

FIG. 1.—Micrococcus tetragenus in antral pus. Magnified 900 diameters.

FIG. 2.—Streptococci. Agar culture from an alveolar abscess. Magnified 900 diameters.

FIG. 3.—Bacteria from saliva and bread mixture. Magnified 900 diameters.

FIG. 4.—Staphylococci and streptococci. Culture from a case of pyorrhœa alveolaris.

PLATE VI.

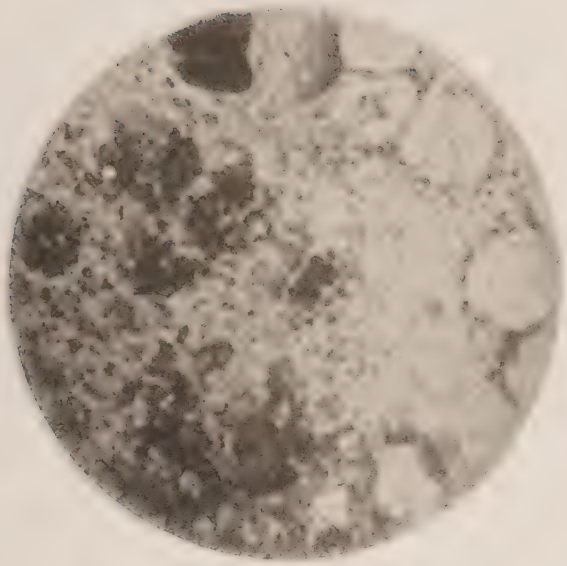


FIG. 1.

FIG. 2.

FIG. 3.

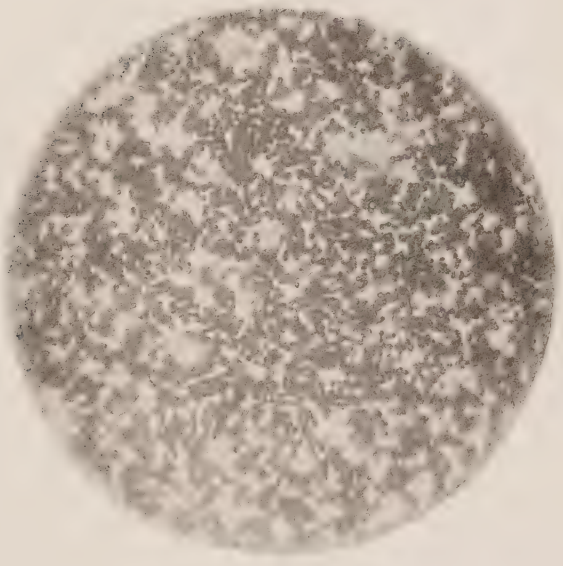


FIG. 4.

The Micro-organisms of the Mouth.

By Edmund W. Roughton, B.S., M.D.Lond., F.R.C.S.Eng.

Mr. President and Gentlemen,—If there were no micro-organisms in the mouth there would be no decay of the teeth, and if there were no decay of the teeth there would be very few dentists, and consequently the Odontological Society would have no existence. No further apology is necessary, I think, for bringing this subject before you to-night.

Perhaps I may not be able to tell you anything that the majority of you do not know already, nevertheless, I hope that your time will not be wasted if I bring before you in a practical way a subject, the importance of which to the dentist and to the surgeon who operate upon the mouth cannot be over-estimated.

I propose to deal with the subject in the following order :—

1. The non-pathogenic organisms of the mouth.
2. The pathogenic organisms.
3. The effects of these organisms on the mouth and other parts of the body.
4. Practical conclusions.

I. The Non-Pathogenic Organisms of the Mouth.

The mouth forms an excellent incubator or warm chamber for the growth of bacteria; its temperature is pretty constantly about 37° C., which is found to be the optimum temperature for the growth of most organisms; sufficient access of air is afforded for those germs which require oxygen or are indifferent to its presence. Food material for them is present in abundance; dead and cast-off epithelium affords nourishment for at least some germs, for it is not uncommon to find squamous epithelial cells covered and partly disintegrated by chains of bacteria. Particles of food remaining between the teeth after a meal are utilised by bacteria; this may easily be proved by chewing up some bread and placing it in a stoppered test tube in the incubator; after two or three days, examination under the microscope will show that many different sorts of bacilli and micrococci are present in abundance (fig. 3, plate vi.). Even such a hard substance as dentine is, when decalcified, readily devoured by many of the mouth bacteria. When we add to the above food materials the exposed pulps of teeth, buccal mucus, and inflammatory exudations from the gums, we shall see that there is no lack of nourishment for germs resident in the mouth. Wherever there is something worth having and nothing to pay for it, it is only

natural to expect a crowd; and so it is in the mouth, for here germs simply abound. Whenever we open our mouths to take in food, drink or air, we admit at the same time a great many micro-organisms of different sorts, and it is only reasonable to expect that they, finding such comfortable quarters, should settle down and propagate. These considerations might lead one to suppose that the human mouth would contain every single germ in existence; and so it would were it not for "the struggle for existence" which is constantly going on everywhere, causing the stronger to prevail and the weaker to perish; thus it is that although over a hundred different sorts have been discovered, the number of regular tenants of the mouth is very small, viz., about six. It seems that the conditions in the mouth exactly suit these few bacteria, enabling them to crowd out all others; moveover, it is a strange fact that they absolutely refuse to grow outside the mouth on any of the artificial nutrient media of which we know.

If a small portion of the soft white matter, which collects upon the teeth, be spread out in an extremely thin layer upon a cover glass and stained with an anilin dye, such as gentian-violet, a specimen of great beauty and interest, from a bacteriological point of view, will be produced. If we examine it with a one-twelfth oil immer-

sion lens we shall see swarms of micro-organisms of different sorts and sizes, some being rod or thread shaped, some round or egg shaped, and other spiral or screw shaped.

(*a*) *The rod-shaped organisms.*—Of these there is a great variety, both with regard to length and breadth, some of them being jointed transversely and others jointless. The name leptothrix is commonly given to the jointless thread-like forms; the name, however, is not a good one, as authors are not agreed amongst themselves what to include under it, and what to exclude. Most commonly leptothrix filaments appear as a jumbled-up heap, like an entangled piece of string; sometimes the threads are much larger and wavy in outline, many threads being attached to a sort of common root of structureless material, as in fig. 2, plate i.

The jointed rod-shaped organisms (bacilli) also vary greatly in size; notable amongst them on account of its dimensions is the bacillus buccalis maximus, which is found in long thick jointed rods about three to ten μ long, sometime singly, sometime in tufts. It is stained violet by iodine, whereas the leptothrix remains unaffected. Many other bacilli will usually be seen in different specimens and in different mouths; some of these being pathogenic will be referred to subsequently.

(*b*) *Spherical Organisms or Micrococci.*—The micrococci, although perhaps as numerous, are on account of their smaller size less conspicuous than the bacilli and threads. They are sometimes in clusters, sometimes in chains, or tetrads, or pairs, or scattered singly. The pairs, tetrads and chains, when short, are sometimes enclosed in a transparent glassy-looking capsule.

(*c*) *Spiral Organisms.*—The occurrence in the mouth of curved organisms resembling a comma has long been recognised. Professor Lewis drew especial attention to them, and he and Klein at one time regarded them as identical with Koch's cholera bacillus, but subsequent investigation has shown that although much alike in morphological character, they differ in this marked respect, viz., that whereas the cholera vibrio grows readily on gelatine, the comma bacillus of the mouth (spirillum sputigenum) refuses to grow anywhere but in the mouth. In an ordinary clean and healthy mouth it is found in small numbers, but under the margins of slightly reddened and inflamed gums it is found in large numbers. When examined in the hanging drop, *i.e.*, in its natural live state, it is seen to be highly motile; it is by means of flagella or whip-like processes that these motile organisms move about. The number and mode of attachment of the flagella varies a good deal; in some of them only one

flagellum is to be seen, attached either to one end, or to the middle of either the concave or convex side of the comma, whilst in others a bunch of four or five flagella is not infrequently seen. They may exceed the length of the comma itself by several times; they cannot be seen in the unstained condition, nor indeed by the ordinary method of staining. They require to be treated with a mordant, and then stained after the method of Loeffler. Sometimes two or more comma bacilli may be seen in a row, end to end, forming a short spiral; this is due to incomplete fission.

Another spiral organism often found under inflamed gums is the spirochœte dentium. It occurs in the form of long wavy spirals of varying thickness and size of twists (figs. 1 and 2, plate i.). It has been supposed to be a stage in the development of the spirillum sputigenum. I cannot, however, accept this view, for the spirochœte is much thinner and takes the stain with much less readiness than the spirillum sputigenum; moreover the short spirals formed by the latter are much coarser and more clumsy looking. Very little is known about this organism.

II. The Pathogenic Organisms of the Mouth.

The organisms which I have just described, and which occur in nearly every mouth, are

nearly all of them non-pathogenic, *i.e.*, they are incapable of producing any morbid condition when injected into the blood or tissues of an animal. The fact that they are uncultivable has rendered it probable that they are also uncultivable pathogenic organisms inhabiting the mouth; indeed such organisms have been described by Kreibohm and by Miller. But passing these by, there are others which have been cultivated and very fully studied.

It has long been known (even to the ancients) that the human saliva was poisonous, although it has been a popular idea that saliva was an excellent lotion for slight wounds. This toxic property has been, from time to time, attributed to various causes, but it was first shown by Raynaud and Lannelongue in 1881 that it was really due to the presence of micro-organisms. About the same time Pasteur discovered in the mouth of a child suffering from hydrophobia an encapsuled diplococcus resembling the figure 8. Saliva containing these germs, when injected into rabbits, produced a rapidly fatal result. This he considered to be the specific germ of hydrophobia, but Vulpian soon afterwards produced the same symptoms and fatal result by injecting healthy saliva, and the same capsule cocci were found in the blood of the dead animals. A. Fraenkel discovered the same organism in cases of croupous pneumonia, and

others have since found it in peritonitis, pleurisy, meningitis, otitis media, and other inflammatory processes. Fig. 4, plate v., shows an encapsuled diplococcus in pus from an empyema of the antrum. In the causation of these various diseases it plays a most important part, if indeed it is not solely responsible for them. This important organism is now designated the micrococcus of sputum septicæmia. It occurs frequently in the mouths of healthy persons in the form of encapsuled diplococci, which are not always easy to find under the microscope, but whose presence may be demonstrated by injecting some of the saliva into mice. Out of one hundred and eleven mice killed in this way, Miller found the micrococci of sputum septicæmia in the blood and tissues in sixty-one. The saliva had been taken from a different person in each case.

This micrococcus will grow on culture media, but not readily. It requires a temperature somewhere between 24° and 42° C., and a faintly alkaline medium. The colonies resemble dewdrops in appearance. They will not live much longer than five or six days, after which time, if it is desired to further propagate the species, it must be done by passing it through the body of a susceptible animal, and from its blood inoculating fresh culture media.

The descriptions of this organism by different

observers differ somewhat in detail. This fact, coupled with its widespread pathogenic action, has led one to suspect that there may be more than one variety of it. Miller has described four separate varieties, which he designates by the numbers 1, 2, 3 and 4.

No. 1 is identical with the pneumococcus of Fraenkel. It is always encapsuled in the body, but never in cultivations.

No. 2 differs slightly from No. 1 in its growth on artificial media, and is encapsuled in artificial cultures as well as in the body.

No. 3 differs but slightly from No. 1.

No. 4 differs from the others in that it very soon loses its virulence in passing through the bodies of mice.

Many other pathogenic organisms have been found in the mouth and isolated; in a short paper like this it is impossible to describe them. Some of them will, however, be referred to in the next section.

III. The Effects of Micro-Organisms on the Mouth and other Parts of the Body.

(*a*) *Local Effects.*—Dental caries is nothing more or less than the devouring of the teeth by the micro-organisms of the mouth; the only conditions that the germs exact are that the dentine shall be exposed by removal of its enamel cover-

ing, and decalcified by acids. Of course, the causes which bring about these conditions are manifold; nevertheless in a perfectly germless mouth there could be no caries.

In sections of decayed dentine the tubes are found to be crammed with different sorts of bacteria. This is shown in fig. 1, plate iii. In the specimen from which this photograph was taken, the infection was mainly by micrococci. In some places the tubes are bulged by the pressure of the growth inside them, forming the so-called liquefaction foci. Fig. 2, plate iii., shows a small part of a similar specimen more highly magnified the individual micrococci being plainly visible. Fig. 1, plate ii., shows a dense fringe of leptothrix filaments adhering to the wall of a cavity, and extending into the dentinal tubes. Fig. 2, plate ii., shows infection with bacilli and thread forms. Fig. 2, plate iv., shows the appearance presented by decayed dentine in transverse section; the tubes themselves are crowded with dense masses of bacteria, whilst between them wavy filaments of leptothrix spread out in all directions.

Sooner or later the decay (and the bacteria) extends, if unchecked, to the pulp cavity, causing acute inflammation and perhaps gangrene of the pulp; the bacteria may then extend to the apical foramen, producing an alveolar abscess with its

possible results, such as disfiguration of the face, necrosis of the jaw, spreading suppuration, septicæmia, pyæmia and death. Such cases may be found recorded in considerable number in medical literature. Fig. 2, plate vi., is a pure culture of the streptococcus pyogenes, from an alveolar abscess the result of a buried stump.

Extension of inflammation from the teeth to the maxillary antrum is well known. From one such case I was able to obtain specimens of a diplococcus (fig. 4, plate v.), probably the M. of sputum septicæmia, the M. tetragenus (fig. 1, plate vi.), torula and staphylococci (fig. 3, plate v.), the bacillus buccalis septicus (fig 1, plate v.), and other bacilli (fig. 2, plate v.). No doubt there were others in the same case which I failed to detect.

The various inflammatory and catarrhal conditions and ulcers about the mouth are to a large extent due to the action of bacteria. Some local or constitutional condition diminishes the vital resistance of a part of the mucous membrane, and so permits of its invasion and destruction by germs.

I have no doubt that pyorrhœa alveolaris is produced in this way. This disease, although familiar to every dentist, is often overlooked, I am sorry to say, by physicians and surgeons. There has, as you are aware, been much dis-

cussion among dental pathologists as to the nature of this disease; some have held that it is a purely local affection, and others that it is entirely constitutional. Now the truth is, I believe, half way between the two, as is so often the case when two schools take diametrically opposite views. In all germ diseases it is necessary to lower the vitality of the part before the germs can touch it. There are very few, if any, germs which, when placed upon a perfectly healthy uninjured mucous membrane, can do anything but die. There are many obvious ways in which this lowering of vitality may be brought about in pyorrhœa alveolaris. Accumulation of tartar, slight gingivitis, injuries to the gum, &c., may be cited as local predisposing causes, whilst struma, gout, syphilis, rheumatism, and wasting diseases act as constitutional predisposing causes. Germs are present in abundance in the pockets between the gums and the teeth, as any one may convince himself of by making a cover-glass preparation of the pus which oozes out on pressure. Fig. 4, plate vi., is a photograph of a culture on agar-agar inoculated from the pus in a case of pyorrhœa after cleansing the surface of the gums. It consists of pyogenic staphylococci and streptococci. Miller has isolated twenty-two different organisms from

twenty-seven cases of pyorrhœa. It would appear, therefore, that there is no one special germ which can claim this disease as its own, but that any of the pyogenic bacteria may produce it when the necessary predisposing causes have prepared the ground for it. That pyorrhœa is in reality a germ disease is further corroborated by the remarkable effect of treatment by perchloride of mercury. Recently, a woman came to my out-patient department at the Royal Free Hospital with very spongy bleeding gums, and pus welling up in abundance from between the teeth and the gums. I advised her to cleanse the gums, and then twice a day to stuff down minute wisps of cotton wool soaked in 1 in 2000 perchloride solution into the gum pockets, working carefully around each tooth. When she presented herself a week later the gums presented a natural appearance, no longer bleeding when touched, and no pus oozing up on pressure. The worst of this treatment is that when efficiently carried out it diminishes the discharge of pus so quickly that patients are apt to think they are cured, whilst there is still some minute suppurating spot between or behind the teeth from which the disease may spread again. The teeth tighten up wonderfully after this treatment in recent cases, but of course

when much absorption of the alveolus or necrosis has occurred it is impossible to restore the lost socket, and the teeth remain loose although the suppuration has been stopped.

(*b*) *Remote Effects.*—After all large operations on the mouth one of the greatest dangers to be feared is some form of septicæmia, for by such proceedings we bring about conditions very favourable for the entrance of germs into the system—in fact, we imitate very closely the experimental injection of septic saliva into animals, the fatal results of which have been already alluded to. Perhaps at the time of the operation when we make our incisions, germs may enter directly into the circulatory system. The abundant oozing of serum from the large raw surfaces left by the operation affords additional culture medium for the growth of micro-organisms; the injury inflicted directly on the tissues diminishes their vitality, and thereby their power of resistance to septic infection, and the loss of blood (always serious in a large mouth operation) weakens the whole system and still further renders it a prey to the ravages of invading micro-organisms. Not only after large operations, but after the extraction of teeth and lancing of gums, fatal septicæmia has occurred. Not only may a dirty mouth serve as a source of infection for its owner, but also for other patients operated

on with the same instruments imperfectly cleaned. It is well known that syphilis has been inoculated in this way, and, perhaps, other diseases too. It must also be remembered that there is risk to the operator as well as to the patient in the performance of an operation in an unclean mouth. Both local and general infection may follow injuries to the fingers by ragged teeth or dental instruments. Miller has recorded a case of chronic pyæmia in a dentist who injured his finger with a burr whilst clearing out a decayed tooth. The result was suppuration in the wounded finger, the axilla, the lungs and elsewhere, no less than 135 abscesses forming in the course of two years. The pus contained the bacillus buccalis septicus, an organism frequently found in the mouth.

An unclean mouth, coupled with nasal obstruction and a weak state of the general health, are the conditions most fruitful in producing inflammatory conditions of the throat, and (by extension along the Eustachian tube) of the middle ear. The pneumococcus of Fraenkel and the pneumo-bacillus of Friedlander (both of them frequent residents in the mouth) have been found in otitis media and in cerebral abscesses consequent upon it.

Allusion has already been made to septicæmia following an operation upon the mouth. One of

the commonest forms of it is septic pneumonia, produced by the inhalation of septic matter from the mouth. The fact that the pneumococcus of Fraenkel and the micrococcus of sputum septicæmia are almost certainly one and the same, leads one to suppose that many cases of acute lobar pneumonia may be the result of direct infection from the mouth. At first sight this does not seem to harmonise with the well-known fact that pneumonia often follows directly upon exposure to cold winds, immersion in cold water, or some other form of "catching cold." But the depressing influence of cold simply diminishes the vital resistance of the lungs, and so places them at the mercy of any germs which may be inspired from the mouth or outside air.

When we swallow food or saliva we take into our stomachs hosts of germs, many of which are capable of setting up diverse forms of fermentation and so disordering digestion. This fact, I believe, is lost sight of by many physicians, who treat dyspepsia without ever inquiring into the condition of the mouth and teeth.

IV. Practical Conclusions.

Having seen the disastrous and widespread results which may follow infection by the micro-organisms of the mouth, the necessity of dealing with this cavity by antiseptic methods will be

obvious. I rejoice to see that one very important branch of this subject is being actively pursued by those gentlemen who are interesting themselves in the condition of the mouths of school children. Their labours will, I trust, avert much suffering in the future.

It is not possible to conduct an operation in the mouth with the same certainty of avoiding septic infection as we can when operating on a limb, but the same principles should guide us, and we should all strive to obtain asepsis by every means in our power. It has been the custom of surgeons, and still is so, to a very large extent, to drop their antiseptics when operating in the mouth, regarding it as a situation where asepsis is impossible and therefore not worth trying for. I consider such practice to be thoroughly bad. It should be a rule that before an operation is performed within the mouth, the condition of the teeth should, when possible, be examined and dealt with by a dental surgeon. Immediately before the operation, when the patient has been anæsthetised, the mouth should be well mopped out with cotton wool soaked in 1 in 1000 perchloride, and after the operation it should be frequently syringed with some milder antiseptic.

I am unable to say what precautions against infection are taken by dentists when extracting teeth. I can only suggest that if they are not

adequate the sooner they are improved the better. In a short paper like the present one, I have found it impossible to do more than give a brief general sketch of the subject, and insist upon the more important practical points ; many things have of necessity been omitted. My hope is that by bringing the micro-organisms of the mouth before you in a practical demonstration, I may do you and your patients some slight service.

Discussion.

The President having thanked Mr. Roughton for his paper, said with regard to the growth of pathogenic organisms in the mouth, he might say, as an example of the contradictory statements occasionally met with on scientific subjects, that it had been stated that the saliva was inimical to the growth of pathogenic micro-organisms, although the contrary view was generally accepted. He would like to ask Mr. Roughton how the specimens showing the flagella were prepared, as it was usually necessary to make a culture in bouillon in order to show the flagella. With regard to the Finkler-Prior bacillus, he had thought that it was classed with the pathogenic organisms. In reference to the micrococcus tetragenus, he believed that Dr. Miller had found from experiments on mice that an inoculation of a culture was seldom, if ever, fatal. It was of course well known that the ordinary organisms of suppuration were found in pyorrhœa alveolaris, but it was still quite possible that the real cause of the disease was an organism that could not be cultivated out of the mouth, and he also thought that it did not usually succumb to treatment so easily as in the instance mentioned. He would also ask Mr. Roughton if he had met with a mixed infection of bacilli and micrococci in the same dentinal tube. He (Mr. Mummery) had often seen mixed infection, but never the two varieties of organisms in the same tube —although Dr. Miller had seen and described such a condition. Having regard to the conditions of dental operations, he thought mopping out the mouth with perchloride of mercury while the patient was under an anæsthetic would be a very inefficient means of sterilisation, and did not think it would prevent the conveyance of organisms into the tissue in the operation of extraction.

Mr. Storer Bennett asked whether the specimen showing organisms derived from a case of pyorrhœa alveolaris was a cultivation, or a cover-glass preparation obtained directly from the discharge, for in his experience it was very difficult to obtain a true cultivation of such organisms, and cover-glass preparations made directly from the discharge showed a very mixed infection.

Mr. William Hern noticed amongst the excellent micro-photograph pictures of micro-organisms shown by the lantern, some almost, or quite, pure cultures, and he would like to ask Mr. Roughton what method he adopted to procure these pure cultures. He could not accept Mr. Roughton's statement as to the immunity from infection enjoyed by any healthy body if soaked within and without with micro-organisms; there were a large number of pathogenic organisms which he (Mr. Hern) would not care to trust himself personally to come into any such contact with, even when enjoying the best of health. He wished to congratulate Mr. Roughton on such rapid and successful treatment of a case of pyorrhœa alveolaris, as that mentioned by him, with a single application of 1 in 1,000 solution of bichloride of mercury to the gum margin. Cases of pyorrhœa alveolaris, in his experience, required much more lengthy and laborious treatment, including the removal of hard, tartar-like bodies from the roots of the teeth affected, before obtaining such a happy termination to a case.

Mr. Henri Weiss asked, in view of the indisputable fact of the existence of these micro-organisms, and the suggested injurious influence on the teeth, whether Mr. Roughton could propose a suitable germicide for the mouth. He submitted that the mouth was not the most convenient situation for the exhibition of poisonous drugs, and even those which could be tolerated without danger to life, the results proved to be most disastrous to the teeth. In illustration of this he mentioned carbolic acid in the form of carbolic tooth powder, whereby caries was aggravated to a most alarming extent. In the use of bichloride of mercury, from experiments in another direction, he had found great

discoloration of the tooth tissues, and in some instances exfoliation of large pieces of the alveolar process. He would therefore ask Mr. Roughton to name a drug which would destroy these germs, and yet not be injurious to the contiguous parts.

Mr. ROUGHTON, in reply, said that he had been able to stain the flagella of the comma bacilli taken directly from the mouth. He took a small portion of the deposit from under the gum and mixed it with a little tap water, so as to form a milky fluid; a minute drop of this fluid was smeared across a perfectly clean cover glass in a very thin layer; the cover glass was then dried in the incubator, and fixed by passing three times through a flame. It was then heated in a mordant made by mixing a saturated solution of ferrous sulphate with a 20 per cent. solution of tannic acid; the mordant was next thoroughly removed by streaming with distilled water, and lastly with alcohol; it was then stained with carbol-fuchsin. He admitted that there might be a special germ of pyorrhœa which was uncultivable; however, he thought it more probable that any of the pyogenic germs could produce this disease in a mouth prepared for their reception by accumulation of tartar, gingivitis, or other causes lowering the vitality of the gums. The specimen shown on the screen was a culture on agar. Many members seemed hardly to believe the account of the case of pyorrhœa he had cited; they must remember, however, that the case was in an early stage, and although there was profuse suppuration, there was no damage to the sockets of the teeth. Perchloride of mercury would stop the suppuration in an early case, but could not be expected to cure a case in which there was a great accumulation of tartar, necrosis of the jaw, or absorption of the sockets of the teeth. In answer to the President, he said that he had not seen dissimilar germs in one and the same dentinal tubule. In answer to Mr. Hern, he said that he had used chiefly the method known as the "line culture," for obtaining pure cultivations. Mr. Hern had mentioned syphilis as an example of germs being able to attack a perfectly healthy tissue; he thought that in most,

if not all, cases of syphilitic infection there was some crack or abrasion, or some spot of diminished resistance. He made it a rule to mop out the mouth with a 1 in 1,000 solution of perchloride before performing any operation within its cavity; he was aware that it was not possible thereby to completely sterilise the buccal cavity, nevertheless he contended that by diminishing the number of living germs in the mouth (as this proceeding certainly did) the risk of the operation was diminished in the same degree. He thought that the danger of washing out the mouth with perchloride had been over-estimated, as the amount used was scarcely as much as an ordinary medicinal dose of that drug.

The PRESIDENT then called upon the scrutators to announce the result of the ballot, and he declared the following officers duly elected for the ensuing year.

PRESIDENT.

W. Bowman MacLeod.

VICE-PRESIDENTS.

Resident: T. H. G. Harding, R. H. Woodhouse, Morton Smale.

Non-Resident: R. T. Stack (Dublin), F. H. Balkwill (Plymouth), W. E. Harding (Shrewsbury).

TREASURER.

S. J. Hutchinson.

LIBRARIAN.

Ashley Gibbings.

CURATOR.

Storer Bennett.

EDITOR OF TRANSACTIONS.

E. Lloyd-Williams.

HONORARY SECRETARIES.

W. A. Maggs (*Council*), Cornelius Robbins (*Society*), J. F. Colyer (*Foreign Correspondence*).

COUNCILLORS.

Resident: F. J. Bennett, E. G. Betts, B. J. Bonnell, J. Ackery, A. Underwood, Harry Rose, C. D. Davis, Charles Truman, W. R. Humby.

Non-Resident: T. S. Carter (Leeds), W. S. Woodburn (Glasgow), W. H. Williamson (Aberdeen), H. C. Quinby (Liverpool), D. W. Amoore (St. Leonards), Wilson Hogue (Bournemouth), G. G. Campion (Manchester), J. McKno Ackland (Exeter), J. H. McCall (Leicester).

The PRESIDENT then read his Valedictory Address :—

THE PRESIDENT'S VALEDICTORY ADDRESS.

GENTLEMEN,—In many circumstances of life it is important to pause now and then and take a retrospective glance over the ground we have already traversed. This I take to be the intention of a valedictory address, and in the few words to which I shall confine myself to-night, I propose to briefly review our work during the past session, and refer to any advances that have been made either at home or abroad. This has not been an eventful year in the Society, but the history of a Society, like that of a nation, is not only made up of serious crises, and events which leave their distinguishing mark on its history, but also by the daily routine of regular work. During this year I think we may be said to have done as good work as in the past. We devoted one evening to a discussion on irregularities of the teeth, confining our attention on that occasion to anterior protrusion of the upper jaw. Mr. David Hepburn opened the discussion, which was well maintained in a very full meeting. Such discussions, at all events once in a session, are, I think, a pleasant addition to our programme, and of practical value to our members. Mr. Charles Tomes gave us a very interesting paper on the growth of the jaws, the result of a study of a series of models in the

Museum of the Royal College of Surgeons, representing the same mouth from the age of 4 to the age of 21. These models clearly show that "in the region of the jaw occupied by the temporary teeth, very little growth or change subsequently takes place, so that it comes to pass that the incisors, canines and bicuspids ultimately occupy an arch which hardly differs in either size or shape from that occupied by their predecessors." From an interesting comparison made with the skulls of the chimpanzee, ourang, and gorilla, Mr. Tomes demonstrated that this is an especially human character—considerable growth taking place in this region in these animals. Dr. Hewitt gave us an elaborate and interesting paper on his method of administering oxygen and nitrous oxide. He stated that by the employment of oxygen the symptoms of jactitation, stertor and lividity, so common with nitrous oxide alone, did not appear. The after effects, he appeared to consider, were not so satisfactory as with nitrous oxide. Mr. Storer Bennett's paper on "Some Mechanical Devices for the Retention of Artificial Dentures" displayed a very large amount of ingenuity in overcoming difficulties, and his hinged bands may no doubt prove to be of great value in some of those very difficult cases we all occasionally meet with. In December Dr. Sims Woodhead read us a paper on "Inflammation in Bone," in which several new and interesting points were presented, especially with reference to the action of leucocytes, and to the production of areas of calcification in degenerated tissue. This paper might suggest several lines of research to those interested in the pathological histology of the jaws.

Our usual casual communications have also well sustained the average of former years, both in number and importance.

Some important researches connected with the teeth have reached us from abroad during the past year. Dr. Mor-

genstern (of Baden) has described nerve terminations in dentine, enamel and cementum ; he speaks of small bodies containing one or more nucleated corpuscles, in which he finds the terminations of ultimate nerve fibrillæ, which he considers he has traced back into the pulp, and which he describes as running in separate channels in the dentine. As, however, this is no more than a brief preliminary communication, was accompanied by no drawings, and has not been followed by any fuller statement, we must suspend judgment on this most important histological investigation until such time as the author sees fit to give to the world the full details in proof of his work. Another research by Dr. Carl Röse, of Freiburg in Baden, on the development of the teeth, is of considerable interest. By adopting Born's system of modelling, in which a solid model is built up in wax from a number of drawings of serial sections, drawn to the same scale and cut to a certain definite thickness, he is able to trace the course of the primitive tooth germ band in the fœtal jaw with much more certainty than is possible with single sections. His results seem to demonstrate that the temporary tooth germ does not give rise to the germ of the permanent tooth, as has been generally supposed, but that the tooth band grows obliquely backwards in the jaws, and after giving off a band dipping down to form the temporary teeth, continues growing backwards, and itself forms the permanent teeth. He has used the same method in examining the fœtal jaws of several classes of the mammalia with similar results. I had wished to have the models referred to with me to-night for presentation to our museum, but I have not received them from Germany in time. I hope, however, they will arrive before the next meeting.

With regard to matters during the past year more intimately connected with the internal working of the Society, I regret to say that we have received the resignation of our

honorary treasurer, Mr. Thomas A. Rogers. We are all aware how invaluable Mr. Rogers' services are, and always have been, to the Society; no more efficient treasurer could possibly be found, or one who has devoted more time and interest to our welfare. It is with much regret that we receive this resignation, hoping, however, that Mr. Rogers will long continue among us to render the important advice his long experience enables him, and his kindness always prompts him, to give us. As you have heard by the Treasurer's Report, he leaves the finances of the Society in a flourishing condition, and I am sure we may congratulate ourselves on having obtained the valuable services of our late President, Mr. S. J. Hutchinson, to carry forward to future years this excellent balance sheet. It has been decided by the Council to have, in future, an annual official audit, in addition to the usual one by the auditors appointed at the December meeting. Two vacancies having this year arisen in the Trusteeship, by the death of Mr. Cartwright in 1891, and the resignation of Mr. Barrett, Mr. Forsyth and Mr. Alfred Woodhouse have kindly consented to act with Sir Edwin Saunders as trustees. The Council have this year undertaken the important work of revising their resolutions from the commencement, and the Sub-committee appointed for the purpose has devoted much time and attention to the matter, several prolonged special meetings of Council having been also held for the same purpose. This revision has involved an unusual amount of work for our honorary secretary to the Council, which has been carried out in such a thorough and efficient manner, that I am sure the members of the Council will wish me to take this opportunity of expressing their appreciation of those services, which have involved, among other things, the preparation of a perfect volume of Minutes.

We have this year also taken the measure of copyrighting

our *Transactions*, and decided that a list of exchanges shall be published yearly. As you are aware, Gentlemen, we have been this year in the condition of tenants under notice to quit, our landlords, the Dental Hospital of London, having been considering the advisability of increasing the hospital accommodation ; but we have recently received an assurance that our eviction is not imminent, and that circumstances may admit of our still retaining our connection with the Hospital. Our list of new members for the year is an encouraging one. Thirty ordinary members have been elected, and one honorary member, and there has been one readmission. We have nine resignations and three cases of removal of members for non-payment of subscriptions. We have also, as you have heard, had sixteen new nominations read this evening. It is my painful duty to have to record a good many losses by death among our members during the past year. In Mr. Vasey we have lost an old and valued member of the Society and a former President. In Mr. Felix Weiss we have lost an enthusiastic worker for our Society, who served many years on the Council, held the offices of secretary and president, and for several years most efficiently fulfilled the duties of librarian. Among our list of deaths we must also number Mr. A. Fothergill of Darlington, Mr. H. A. Bevers, Mr. Cooke Parsons, and Mr. T. M. Kelly. Two former members of our Society, Mr. Richard White, of Norwich, and Mr. Henry Moon, have also passed away. Mr. Moon was a former Vice-president, and was dental surgeon to Guy's Hospital, and a member of the Examining Board of the Royal College of Surgeons. We have also to record the decease of an honorary member, Dr. Alfred Carpenter, and as your representative, Gentlemen, I was invited to attend the funeral of a very distinguished honorary member of our Society who has this year also passed away. Professor Richard

Owen has long occupied a prominent position in the scientific world, both here and abroad; the great industry and wide grasp of scientific subjects which led him to such just and accurate conclusions in palæontology and comparative anatomy point him out as one of the most remarkable men of the age. As a comparative anatomist, Professor Owen occupies a foremost position in the century. He never was willing to accept the doctrine of natural selection according to the views of Darwin and Wallace, being wedded to his own theory of archetypes, but this was no hindrance to an amount of accurate work in all departments that is absolutely astonishing. Some idea of a part only of this work may be obtained, when we remember, as stated in a recent notice in the *British Medical Journal*, that the list of his scientific papers in the Royal Society's Catalogue occupies twenty-eight columns. To us, as a profession, his labours are especially interesting, for one of his greatest works is his "Odontography," consisting of two quarto volumes, containing 168 plates, a book which is a remarkable example of accuracy. It is astonishing that with the imperfect methods of investigation known at the time, he should have produced a work which still stands alone as the authoritative text book on the subject of which it treats. As an example of his accurate knowledge and faculty for correct deduction may be mentioned the foreshadowing of the discovery of the fossil birds of New Zealand. From a small fragment of a long bone, which did not include the articular extremities, he stated his belief that a large bird of the ostrich family, but of a heavier build, would be found in New Zealand. The discovery of the numerous remains of dinornis within three years fulfilled his prophecy in every particular. Professor Owen's discovery of the toothed odontopteryx in the London clay, may also be said to have foreshadowed that most interesting discovery of the toothed

birds of Kansas, by Professor Marsh, of Yale College, and to have perhaps unconsciously helped forward the theory of natural selection, by affording one of the first important indications of the descent of the birds from reptilian forms. In the extensive biographies which have lately appeared, you will have seen fuller particulars of this most interesting life; but I have purposely referred more to those researches which bear upon our special subjects.

It is pleasant to turn from the sad episodes of the year, to notice an event which has just taken place in Paris, in which another celebrity has just received, on his seventieth birthday, an ovation worthy of his fame and of the cause of science which he represents. In the reception given to M. Pasteur, we have "a date in the history of science." We all know how Pasteur, from his studies in chemistry and fermentation, gradually built up the foundations of the modern knowledge of the causation of infectious diseases. We see how, not contented with scientific demonstration, he has carried the practical results of his discoveries into all departments of application. With M. Pasteur science and practice have gone, as they always should do, hand in hand. Sir Joseph Lister, in addressing M. Pasteur, said:—"Infectious diseases constitute the great majority of the complaints which afflict the human race; you can therefore find no difficulty in understanding why medicine and surgery hasten on this solemn occasion to lay at your feet the deep homage of their admiration and their gratitude." While so many have passed away in the full vigour of their work, it is pleasing to see the great scientist, who has reached his threescore years and ten, receiving the acknowledgments of the whole scientific world, and preparing, when his own work is done, to pass on what he can to the younger generation, who will see results of his labours, at which we can now only vaguely guess.

The time has now come, Gentlemen, when I must take leave of you as your President. Permit me to tender you my thanks for your forbearance towards my many defects, and to thank you most warmly for the cordial support you have at all times given me. In resigning the chair to the gentleman you have this evening elected as your President, I know that you will have an officer who will devote all his energies to the interests of the Society, and under whose guidance, I am sure, you will have a most successful session. The excellent assistance which I have at all times received from the honorary secretaries deserves my warmest acknowledgments, and the anxiety which I felt on undertaking this most important post has been to a large extent relieved by their effectual help, and by your kindness and consideration, upon which I shall always look back with pleasure.

Votes of Thanks.

To President.

Mr. S. J. Hutchinson said that in accordance with the custom which had prevailed in the Society—he thought since it was first established—he had great pleasure in rising to propose on behalf of the members their very warmest thanks to their President for his services in the past year. It needed no words of his to emphasise the admirable manner in which he had carried out the duties of his most important office, nor would they expect him in Mr. Mummery's presence to say all that they felt about him; but he did think that it was only fair to recognise that in him they had one of the most thorough, earnest, and reliable workers in science of the present day—one whose deservedly high position was recognised not only in their own Society, but in all scientific societies throughout the world. They could not but feel that honour had been reflected upon them by his occupancy of the presidential chair. With regard to his personal qualities, he could not say much in his presence, but they had always felt how thoroughly the meetings had responded to his control, owing to the grace, courtesy, and tact with which he exercised it. He was sure that they would all join with him in a hearty vote of thanks and congratulation.

Mr. J. Mansbridge, in seconding the vote, said that he was sure they were all so fully alive to the valuable services which Mr. Mummery had rendered them, that it was not necessary for him to do more than re-echo the sentiments so well expressed by Mr. Hutchinson.

The President, in acknowledging the vote, said that he could not find words to convey his high appreciation of their kindness; he felt that far more had been said than he deserved, and that he had not fulfilled the duties of the honourable position as well as he could have wished, but

he had done his best, and wished to take the opportunity of acknowledging the loyal support that he had received from the Secretaries and other officers, and to thank the members for the manner in which they had helped to make his duties pleasant and easy.

To Treasurer.

Mr. David Hepburn said that it was his pleasing duty to propose another vote of thanks, one which, he was sure, would be heartily received by all. When he came to speak of their Treasurer words seemed to fail him, because in speaking of Mr. Thomas Arnold Rogers, he spoke of one of their oldest and very best friends. There seemed at one time almost a chance of a vein of sadness in connection with this vote—that Mr. Rogers would be no longer an active member among them, and that the only link that would connect him with the Society would be that of honorary membership; but he was glad to say that this had been averted by Mr. Rogers' own wish to remain a paying member. This fitly illustrated his loyalty to the Society. The Society was indeed almost one of his children, for if it was not his child it was certainly his father's child. He was one of those whom they could never afford to let slip from them. When they remembered that he had twice filled the office of President, and that he had also held almost every other office that it was possible to hold, he was sure that in proposing a vote of thanks to him in the heartiest possible way for his long, long years of service, that he was only expressing the unanimous feelings of the Society.

The vote was put, and carried by acclamation.

Mr. Thomas Arnold Rogers said that after he had delivered his Report he hesitated for a moment as to whether he should not return thanks to the Society and its members for all their kindnesses to him. He confessed he was not prepared for the kind words he had just heard, but he should nevertheless like to tender his thanks to the Society, to the Council, and most especially to the Secre-

taries—who had the really hard work of the Society—for the kind support they had given him at all times. It was quite true that he was one of the twenty members—of whom now only eight remained—who originally founded the Society, and they did look upon themselves as the fathers of the Society, and he might say that the dental profession was its mother. The compliment that they had kindly paid him in offering him the honorary membership of the Society he valued very much indeed. He could not, of course, expect to be of any more use, for time brought its changes, and he often felt quite out of place amongst the many able, young, and energetic members who had come forward, but he should like to remain an ordinary paying member of the Society, because he felt that the Society needed all the help it could get, the Reserve Fund had not yet reached the amount to make them independent. He hoped that the contemplated new buildings for the Hospital would be adequate, but however big they might build it it must be outgrown in time. He had never concealed the opinion he had long held, that the Odontological Society should have its own home independently. He could only again thank them very much for their kindness, and especially for the kindness of their farewell that evening.

To Retiring Officers of the Society.

Mr. R. H. Woodhouse felt that they could not allow the retiring Secretaries and other officers to pass out of office without a vote of thanks. It was usual to couple this vote with that of the Treasurer, but in the special circumstances of the case it was rightly felt that it was fitting to separate them on that occasion. He thought that a special word of commendation was due to the Secretaries for their work of the past year; how heavy that work had been was only known to those behind the scenes, and he thought that a special meed of praise was due to Mr. Ackery, who had worked most laboriously and assiduously. The work had been of no ordinary character, and it would have been

difficult to carry it through without his assistance. In saying that much he felt sure the other Secretaries would not imagine that he was detracting from their valuable services. He would also like to refer to the most able manner in which Mr. Coffin had edited the *Transactions* for a long time, and he was sure that he was only expressing the general feeling of the members in saying that his retirement from that office was a matter of great regret to them all.

Mr. J. Ackery begged to thank the Society for their kind appreciation of the work that had been done. It might appear to some that all the work had been done by one Secretary, but he could assure them that such was not the case; it had in reality been done by a committee of five or six members—it was not the work of any single individual. Although the meetings had been numerous, still the work had not been so very serious; he felt that they could scarcely talk of work in the presence of their late Treasurer, remembering all that he had gone through—that during the thirty-six years he had been a member of the Society, thirty-one had been spent in office, and that he had held every office except that of curator and editor of the *Transactions*. He thought that in face of that they could only do their work cheerfully and look forward to more. He really felt ashamed that he had consented to remain in office another year, and thus was keeping someone else out of an honourable position, to the detriment of the Society, for he felt that the occupation of office often started an interest, and gave an incentive for work which would otherwise not be undertaken.

The next meeting of the Odontological Society will be held at 40, Leicester Square, on Monday, February 6th, at 8 p.m. A Paper will be read by Dr. J. Maughan, "Remote Pain in Dental Disease." The President will deliver his Inaugural Address. Casual Communications:—Mr. J. Mansbridge, Models of two cases, showing (*a*) "Retarded Eruption of Temporary Teeth," (*b*) "Retention of Temporary Teeth late in life;" Mr. W. E. Harding, (1) "Case of Artificial Teeth lodged in the Pharynx," (2) "Electric Cautery for Drying Pulp Canals."

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

February 6th, 1893.

Mr. BOWMAN MacLEOD, L.D.S.Edin.

President, in the Chair.

The Minutes of the previous meeting were read and confirmed.

The President said that the Council had recommended Mr. W. Imrie, of Paris, for election as an Honorary Member. He had been for many years connected with the Society, and had at one time been its Vice-president; he had now retired from practice. Mr. Imrie was elected by acclamation.

The President announced that Mr. H. E. Goddard, of Oxford Street, Nottingham, having sent his obligation form duly signed, was now admitted as a Non-resident Member.

The following were balloted for and elected Resident Members of the Society:—Frederick Walter Barrett, L.D.S.Eng., 42, Finsbury Square, London; Ernest Henry Lewis Briault, L.D.S.Eng., 30, Richmond Crescent, Barnsbury, N.; William Thomas Trollope, L.D.S.I., High Street, Tunbridge Wells and London.

Mr. F. W. Richards, L.D.S.Eng., of 27, Paradise Street, Birmingham, was nominated for Membership.

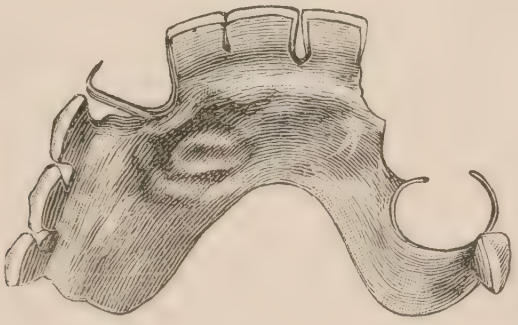
Mr. J. Mansbridge communicated two cases—one of imperfect eruption of temporary teeth, and the other of retention of temporary teeth late in life.

He said: The models, though slightly different, present one condition common to both, viz., the imperfect eruption of certain temporary teeth. The first model is that taken from a boy 4½ years of age, in which the left upper first temporary molar is seen to have the cusps of the crown only through the gum, while the second temporary molar is in its normal position. The second models (upper and lower) are taken from the mouth of a young lady, aged 20. In the upper jaw a similar condition to the above exists with regard to both the second upper temporary molars. These models are also of interest in showing the retention of the four temporary second molars and the upper left temporary canine, whilst demonstrating the effect on the permanent series and the bite.

The reasons for showing these models are: (1) They appear to be of sufficient interest. (2) It would be interesting to know if any Member of this Society holds any view with regard to the cause of this imperfect eruption, a state of things which often applies to the six-year-old molars, this condition being quite independent of insufficient room. (3) I should like to hear what treatment would be considered advisable with regard to the second case, taking into consideration the age of the patient, and the very imperfect articulation.

Mr. W. E. Harding related a singular instance of an artificial denture lodged in the pharynx, and afterwards removed by the patient herself. The particulars were as follows:—The woman went to sleep in an armchair after supper, and awoke suddenly with a sense of suffocation; the difficulty of breathing increasing, a medical man was sent for, but on his arrival he was not made acquainted with the fact that she wore artificial teeth. He introduced a probang into the stomach, and no doubt in doing so dislodged the denture from its position, so that the obstruction to respiration was removed to an extent sufficient to allow of

the patient breathing more comfortably. He then left, but visited the patient every day for a week; during the whole of that time, however, he was not informed that she wore artificial teeth. This went on for three weeks, and the medical man was ultimately dismissed, he being under the impression that the condition was due to spasm. The patient then came to Mr. Harding, and saw his colleague with the object of having some new artificial teeth. They suspected that the teeth which had disappeared were still in evidence, and advised her to go to a medical man. She did not do that, however, but contrived herself to remove the plate from her throat through the mouth by means of her fingers, having managed to get a finger nail under one of the bands. The case was a gold one, carrying seven teeth, and had been worn for many years. A remarkable



circumstance in connection with the case, Mr. Harding thought, was the fact that the plate had been tolerated for so long without setting up ulceration. On questioning the woman, who, he remarked, was of a low order of intelligence, he elicited the fact that her failing to consult a surgeon was due to the fear that she might be "cut about" in some way.

Mr. S. J. Hutchinson and Mr. Quinby suggested that it would be very interesting to have a life size illustration of the plate for publication in the *Transactions*.

Mr. Albert mentioned a case of subluxation of the jaw, the patient being present. He was a man aged 42, who for eight days had experienced considerable discomfort in

opening his mouth, and when he did so the movement was accompanied by a very audible click. Mr. Albert had been unable to detect any cause for the condition; there was no neurosis of any kind, and he regarded the case as almost unique in a patient of that age. He should be glad to receive any hints with regard to treatment; beyond massage he could suggest nothing.

The PRESIDENT then delivered his Inaugural Address.

PRESIDENT'S INAUGURAL ADDRESS.

In accepting the office to which you have so kindly and unexpectedly elected me, I cannot refrain from expressing my deep sense of the responsibilities which devolve on him who occupies so important a chair as that of the Odontological Society of Great Britain.

In my own person I feel that I shall fall short of your just expectation, but with the hearty support, which has already been promised, of the Vice-presidents and the other office bearers, I trust that at the close of the session, when I demit office and hand it over to my successor, I may retire feeling that the interests of the Society have not suffered during my tenure of the presidentship. I further trust you will not charge me with indulging in any false modesty when I say that I feel myself unworthy of this great distinction at your hands, and that I was constrained to accept the nomination, and now the election, in so far that I am the most available medium through which you express your respect for, and your appreciation of, your fellow-members north of the Tweed.

Although the first resident practitioner in Scotland upon whom this distinction has been conferred, I am by no means the one who has done most to earn this acknowledgment at your hands; and you will pardon me if for a moment I refer publicly to two men of my own city who would have done the office more credit, whose work, in connection with dental science and dental progress generally, has been much greater than mine has been, and whose age commands preference. That neither is in this chair to-night is, however, no fault of yours. In the one case, that of Mr. David

Hepburn, the inscrutable hand of Providence has been laid heavily upon him in the fulness of his professional manhood, and by depriving him of his eyesight has laid him aside from active work at a time when the results of his labours were reaching full fruition, and there was every prospect of a rich and well-earned harvest. Although not the originator of the scheme which led to the formation of the Odonto-Chirurgical Society of Scotland, to him belongs the credit of founding it and nursing it until it grew, under his fostering care, into the recognised centre for the propagation of dental science, and the promotion of professional culture and intercourse in the north. A man amongst many, an expert in his profession, of wide and varied culture, slow to offer advice but ever ready and willing to give it when circumstances required it, always to the front when work was required of him, he still takes a living interest in all things pertaining to the profession, and frequently makes a welcome appearance at our Odonto-Chirurgical meetings, listening with all the keenness and interest of youth to the papers brought before the Society. Although thus deprived of wearing the honour which I now enjoy, you have not been slow to recognise his worth, and have given him the more rare compliment of Honorary Membership.

Of the other, Mr. Andrew Wilson, I cannot say too much. Himself the son of a very skilful dentist who practised in the earlier years of the present century, he is an old practitioner, a zealous and active member of the Odonto-Chirurgical, self-sacrificing in the interests of the profession, a good naturalist, and a specialist in comparative dental anatomy. His acceptance of this honour, which you placed at his disposal, would have been a well-deserved crown to a long and honourable career in the ranks of our profession, and he would "by oor ain folks at hame" have been welcomed as a fitting representative of the scientific culture

of the profession in Scotland. Like many other good men and true, he is sometimes embarrassed with an excess of diffidence, which prevents him seeing himself as others see him, and chains him to the fireside or the laboratory at a time when his fellows call upon him to occupy a place on the dais. His presence with us to-night is another proof, added to the many I already have seen, of his kindly nature ; and I can truly say that in all matters professional I feel myself honoured in being associated with him.

On looking over the TRANSACTIONS OF THE ODONTOLOGICAL SOCIETY, and scanning the inaugural addresses of previous presidents, I find that the available field has been pretty well swept, and that there is really nothing of a general character left for me to garner. On the other hand, as all my hobbies for some years past have been without the pale of original research, I feel myself incapable, within the short period between the time of my election and now, to venture upon a scientific topic and treat it in a manner worthy of this Society.

What, then, can I do in obeying the unwritten law which age and custom have rendered imperative? Fortunately for me, as the first President you have chosen from Scotland, there is one subject of which I know a little, and which has not yet been brought under your notice, and being a Society which has for one of its objects the better knowledge of fellow-practitioners, it may please you to hear something about the growth of dentistry in Scotland.

To trace the rise and progress of dentistry in Scotland, we need not for practical purposes go further back than 1760, or thereabouts, when we find Mr. James Rae a member of the Incorporation of Surgeons, and of which Incorporation he was deacon in the years 1764-65, practising dentistry in Edinburgh. He acquired a more than local reputation, and was the first to rescue the practice of dentistry from the hands of the artificer, and place it upon a

scientific and medical basis. He gave lectures on the diseases of the teeth, and by example and precept did everything in his power to rescue this department of surgery from the hands of the ignorant and unskilful, who, at that time, claimed a monopoly of the tooth-healing art. To show that he was a man of no mean standing, and skilful in general surgery as well as in dental surgery, I may mention that in 1779 he was requested by his students to deliver practical lectures on the cases in the Royal Infirmary, which request being highly approved by the managers of the infirmary and the Incorporation of Surgeons, he delivered two separate courses in each year for several years, and thus became the founder of the clinical side of surgical teaching.

His younger son, John Rae, who assisted and succeeded him in practice, had even more skill, and acquired a more brilliant reputation than his father. He also was a member of the Incorporation of Surgeons, and after it became a Royal College, was president of that body in 1804-5. He was reputed a good surgeon, but exclusively confined himself to the practice of the dental branch, and was certainly the most skilful and scientific dentist of his day. It is said that he peculiarly excelled in extracting teeth, so much so that, witnessing his dexterity, the Hon. Harry Erskine characterised the operation as *suaviter in modo, fortiter in re.* He died in 1808. From this time forward the improvement in the ranks was, if slow, steady and substantial, and during the next three-quarters of the century, although the training art was entirely under private preceptors, assisted by voluntary private or collegiate study as circumstances permitted, the race of dentists reared in Scotland was acknowledged to be well grounded in the fundamentals, and whether they stayed at home, crossed the Tweed, or went further a-field, their capability was recognised and their services sought after.

Robert Nasmyth may be regarded as the direct successor of the Raes, and was a man of pre-eminent ability, and of great devotion to scientific studies. Born in 1791, he went early into training, and commenced the study of medicine in the anatomical class of Dr. Barclay. Having gained the L.R.C.S.Edin., he completed his dental training, and in 1815 we find him in practice at 32, St. Andrew Square, Edinburgh, and in 1823 he became a Fellow of the Royal College. He was not only a skilful dentist but a skilful surgeon, and we find him frequently acting as right-hand man to Wardrop, Lister, Syme and Ferguson. John Goodsir, the anatomist, served seven years under Nasmyth, and often declared that he owed much of his skill as an anatomist to his mechanical training at the dentist's bench. The friendship of these two continued through life, and they frequently assisted each other in original research. Nasmyth died in 1870.

The first definite attempt, since the days of the elder Rae, to elevate the education of the future dentist out of the haphazard system—if system it could be called—inherent to private and irresponsible instruction, was made by our learned and genial Surgeon Dentist to the Queen in Scotland, Dr. John Smith, who in 1856 commenced a course of lectures on dental surgery in connection with the Royal College of Surgeons. This was supplemented by a course of clinical instruction in the Richmond Street General Dispensary, and thereafter by the opening of a special dental dispensary at No. 1, Drummond Street in the year 1860. From this period, so far as Scotland is concerned, we may date the uninterrupted growth of that educational movement the results of which we are at present enjoying; for they not only instilled better and higher knowledge in a systematic fashion, but, bringing the students into close intimacy in the acquisition of knowledge, there was de-

veloped a feeling of fraternity and charity which pervaded their intercourse in after life.

These lectures paved the way for the establishment of a kindred, but not a rival institution to the Odontological, which, though restricted in its sphere of territorial action, and necessarily very limited in its membership, has yet played its part nobly, and done much for the common cause we have all at heart. The idea of such a Society for Scotland was first mooted by Dr. John Smith in 1865, in which year he prepared and submitted to a few members of the profession a constitution and bye-laws. The scheme, however, did not meet with the support anticipated, and was therefore at that time abandoned. It lay dormant for a little while until Mr. David Hepburn took the matter in hand; and at a meeting, held March 13th, 1867, it was successfully launched, and became an accomplished fact. Difficulties it had to contend with, external and internal, but, thanks to the tact and catholicity of its office-bearers, it overcame them all; and as it grew in years it grew in strength and usefulness, until now it has become in its own unostentatious way the recognised centre of dental light and leading in Scotland. Only those who knew the profession before the seventies can estimate the height and depth of its beneficent influence from the Tweed and Solway in the South, to Cape Wrath in the North. From the 13th of March, 1867, till now, it shows an unbroken record of stated meetings, where the interchange of thought and the free presentation of experiences have consolidated, exalted, and expanded the power of the profession for doing good, and brought about a friendly unity of action, which pervades the private as well as the professional intercourse of its members. Robert Nasmyth was its first President, though he never occupied the chair. The reason of this is found in a letter to the secretary, in which he says:—

"Kindly excuse my resigning the distinguished office you

have conferred upon me. I have an idea that it is unsuitable and unbecoming in one to hold such a position and not do the duties; and I find at my time of life, and in my state of health, I am quite incompetent for any outside work." The work, however, which he had already done was a sufficient warrant for continuing him in office till the termination of his year. By his original research, and by that done in conjunction with Goodsir, he, for a long period, occupied a foremost position in the surgical and dental world, and now, when dead, his name is still an honoured one, and his memory is green. Some idea of the extent of his labours may be gathered by examining the many specimens which he had collected and classified in his private museum, which may now be seen in the hall of the Royal College of Surgeons of Edinburgh.

The first paper laid before the Society was read by Mr. Williamson, late of Aberdeen, "On the Breaking Strain of Vulcanite"—a subject which at that time was novel and of intense interest; while the last published *Transactions* for November and December, 1892, contained contributions on photo-micrography and the growth of dentine, by G. W. Watson and Dr. Robertson.

The passing of the Dentists Act in 1878 found Scotland prepared for its reception. The Education Committee appointed at a meeting held in Edinburgh under the presidency of Sir John, then Mr., Tomes, on the 6th of October, 1877, succeeded in inducing the Royal College of Surgeons of Edinburgh to institute a Licentiateship in Dental Surgery; and in November of the same year they opened the premises, 30, Chambers Street, as the Edinburgh Dental Hospital and School, the managers of the old dispensary, which at this time was located in Cockburn Street, falling in cordially with the views of the Education Committee, and handing over to the new institution their whole goods, chattels, and money.

For ten years the Hospital and School remained in Chambers Street, slowly extending the foundations of what, I hope, will yet be one of the most famous schools in Britain, until the number of students had so increased, and the number of patients become so numerous, that larger premises were required, and it became necessary to remove to the present buildings in 5, Lauriston Lane.

From these, owing to the needs of the Royal Infirmary, of which incorporation we are tenants, we are shortly to be evicted, and learning wisdom by experience we have just concluded arrangements to secure a site upon which we may build a hospital and school, fitted with all the modern requirements of a great teaching institution, worthy of the profession, and creditable to the city of Edinburgh. The Faculty of Physicians and Surgeons of Glasgow instituted a licentiateship shortly after the Edinburgh College, and the profession shortly afterwards opened a dental hospital and instituted classes in connection with the Andersonian College of that city.

And now, having intruded thus much upon your forbearance with matters provincial, I turn my back for the time being upon Scotland and become cosmopolitan. Looking around and abroad, I see good cheer for the future of our profession. The seed sown by our forefathers is bearing good fruit. All over the world there is an awakening to the fact that dentistry is more than a handicraft, and that general culture and medical knowledge, as well as special training, are the absolute necessary equipment of him who would wage war against the diseases of the teeth. Where schools were, these are being extended and remodelled; where schools were not, there they are being established; and the absolute necessity of having a strictly defined course of education, followed by a thorough examination, is being recognised by the people and their representatives, as well as the fact that dentistry is what its leaders in the profes-

sion claim it to be—a branch of medicine and surgery. The outgrowth of such a conviction is shown in the increasing importance of such societies as this, and their endurance can only be ensured by the members uniting themselves together in the all-embracing bond of the pursuit of truth, and never resting satisfied until they wring from Nature the secrets which tend to the well-being of her children, and to the healthy preservation of the various organs for the performance of that functional service required of them during the "seven ages of man." Such a consummation is yet far in the distance; and we might well despair of its ever being reached if we simply dwelt in contemplation upon the little progress which has been made during the æons since the world was, and failed to mark the rapid strides which our modern *savants* are making in unravelling the relationship between cause and effect. The mysteries of Nature are no longer sacred, awe-inspiring secrets to be let alone, but shrouds of ignorance which provoke to honest, painstaking, reverent endeavour to remove the barrier. Each man, then, to his post; each society to its own domain; and ours be it to make more perfect the application of our specialty by removing the barriers which yet stand between the perfect knowledge of the genesis and growth of the teeth, and the etiology of dental diseases, and when we have mastered these we may hope to have at least touched the magic circle which surrounds *dens sana in corpore sano*. In the meantime, we can apply our greatest energies to alleviating the ills that teeth are heir to, and give our daily thought to the restoration or substitution of the defective organs. My predecessor in office, Mr. Mummery, in his review of the work of the past year, has, I think failed to emphasise sufficiently the fact that he has done much to aid progress towards perfection, by his original investigations and observations on the growth and nature of dentine. I trust that he may be spared to continue and

complete his investigations. We cannot all be such men as Mr. Mummery, but we can do that which lies to our hand honestly, and we can further assist those who are engaged in original research by observing and recording.

One subject which has received much of our attention of late, the subject of anæsthesia and the relative safety of various anæsthetics and their combinations, has resulted in much good; but this good may be still further intensified if the invitation of the Committee on Anæsthetics of the British Medical Association is largely and unbiassedly responded to by the advocates and users of the various agents. But that catechetical investigation will not be deemed complete unless the returns embrace the result of the use of anæsthetics in dental as well as general surgery, and complete returns are given from the centres where chloroform is used upon the lines laid down by Simpson.

The question of technical training in certain handicrafts, prior to, or concurrent with, the method of teaching by apprenticeship or pupilage at present in vogue, is an educational matter which has engaged the attention of some of our members; and we have even had an elaborate scheme published, which proposes to do away with the ordinary workroom training, and teach the whole art and science of dental mechanics in a special technical college, where allied handicrafts and constructive dentistry will be taught in certain proportions, with the view of enabling the pupil to master the manipulative dexterity required of a dentist, without confining him in his training to the more or less routine work which is usually to be found in a number of private workrooms. The scheme is an ambitious one, and displays the ingenuity, versatility and energy of its author, and may in a generation or two become an accomplished fact; but I hardly think that we can say that the time is ripe for us to admit it as within the sphere of practical application. We must first exhaust the opportunities which

are provided in our dental hospitals of supplementing the ordinary workroom training by a theoretical and practical course. When we find that this course fails to meet the desired end, then we may fall back upon or rise up to the advanced theories of Mr. Cunningham, a gentleman to whom the profession is deeply indebted for much good work freely done in its behalf.

In conclusion, might I throw out an idea for your consideration, which, I think, under certain conditions, might lead to the betterment of the average standard of our practice, by enabling every member of our profession more readily to keep in the forefront of modern improvements. This, I think, might be attained by this and other kindred Societies establishing a travelling fellowship, the holder of which, after visiting a selected number of the chief schools of Europe, or of America, or of the Colonies, would upon his return devote a certain portion of time to the giving of post-graduate lectures and demonstrations in the chief cities of Great Britain and Ireland. I do not at this time venture upon any details as to working the scheme, but simply throw out the suggestion that you may give the subject consideration; and if, after it has simmered in your minds for some time, you are favourable to the principle of the idea, we may consider as to the best method of securing a practical issue.

Remote Pain in Dental Disease.

By James Maughan,
M.D.Brux., L.R.C.P.Lond., M.R.C.S.Eng.

Mr. President and Gentlemen,—Before proceeding to read my paper I must first of all express to you my deep sense of the honour you have done me in asking me to address you to-night. Standing before a Society, whose name and work are justly held in such high repute in the dental world, it is but natural that diffidence should be my chief virtue at the present moment. If, after my promise to read a paper, there had been a way of retreat with honour, I feel sure that not only the task of addressing you, but also the comprehensiveness of my subject, would have urged me to obtain my release. However, I shall do my best, and I know your forbearance will be with me.

It has been truly said that " every practitioner of dentistry and of general medicine constantly meets cases of obstinate and inexplicable pain, whose *raison d'être* seems past finding out—cases that yield to no therapeutics, and whose continuance is a standing rebuke to the profession, and a

source of misery to the sufferer." But we may congratulate ourselves on the fact that these cases are becoming fewer and fewer every year. What was once dark and obscure in the doctor's mind as well as in his words, is now illuminated by the side lights of physiology and pathology, which have made such strides in the last few years, all honour to the immortal work of Ferrier, Horsley, Beevor, and Schäfer.

Remote pain in any disease is of common occurrence, but the descriptive details, to say nothing of the pathological *rôle*, are both scant and inexact.

When a child complains of pain in the knee-joint the surgeon invariably examines the hip, but why? Because his experience has taught him that one of the earliest evidences of morbus coxæ is the existence of pain in the corresponding knee. We all know that when a man is passing a calculus down the ureter, he is doubled up with a pain running down to the groin and testicle of the same side. During an attack of epididymitis after gonorrhœa, pain in the front of the thigh is a very frequent symptom. Pain in a testis may, in fact, alternate with pain in a tooth. If there be ulcer of the stomach or disordered liver, we get pain in the interscapular space, or over the right shoulder blade as the case may be. Who will explain why a prick on the thigh

causes a sharp pain at the shoulder blade? Who will answer the question why the uterus should painfully contract while a mother is suckling her infant? So, gentlemen, in your special domain of surgery it must be a matter of importance to be familiar with the common nervous phenomena caused by a dental lesion, as also it must be a matter of interest to you to trace the cause from the effect, and *vice versâ*.

It will be necessary to refer to reflex affections of the muscles and special senses, but only so far as will aid us materially in our present study.

The fifth cranial nerve supplies the teeth, its second and third branches going to the upper and lower jaws respectively. Hence if there be any irritation in a tooth, a branch of the fifth nerve is invariably affected, and this is true whether we are conscious of it or not. Consciousness of sensations is not necessarily co-existent with passage of sensations. Two of the chief duties of a dental nerve are to convey trophic fibres downwards and sensory messages upwards. These messages constitute a species of energy varying in vehemence, say, from that produced by a mild tap on a tooth to that following the insertion of a red-hot darning needle up the fang of a molar.

A portion of a dental nerve may be introduced between the two divided ends of a motor nerve, and it will then transmit a motor impulse. Thus

we are not surprised to learn that, histologically, there is no distinction between a motor and a sensory nerve fibril.

In travelling brainwards along a dental nerve we observe a ganglion by the wayside: Meckel's belongs to the second, the otic to the third division of the fifth. These are undoubtedly local government centres. They are each supplied with a sensory, motor, and sympathetic root, which confer certain specific properties that are dispensed by its branches. But the roots of these ganglia are under the control of an imperial power, and the sensory roots send their feelers to the fifth nerve sensory centre at the base of the brain. Here indeed is the origin of the dental nerves; here is the cell whose elongated process enters the apical foramen as the dental nerve axis-cylinder. The Gasserian ganglion on the root of the sensory fifth is analogous to the ganglia on the posterior roots of the spinal nerves, and one of its main duties is to govern the nutrition of the fibrils that pass through it. Coming to the centre of the fifth nerve we are struck by two things—first, the extensive origin of its fibres, and second, the straggling character of the cells that constitute this origin. The highest fibres arise from a group of cells close to the third cranial nerve, whereas the lowest are traceable as far down as the level of the second

cervical vertebra. In the interval between these two points, viz., along the floor of the aqueduct of Sylvius, and fourth ventricle, and in the substantia gelatinosa of Rolando over the posterior cornua of the spinal cord, the fifth nerve is in intimate relationship with every cranial nerve, from the third to the twelfth inclusive, as also with the sensory spinal nerves lower down. It is interesting to note that those fibres which travel downwards to the spinal cord degenerate when their connection with the Gasserian ganglion is severed. I hope to be able to show that by drawing a string through the medulla separating the centres of the part-facial, the sixth, fourth, and third above from those of the fifth motor, part-facial, auditory, glosso-pharyngeal, pneumogastric, spinal accessory, and hypoglossal nerves below, the sensory fifth centres from upper and lower teeth respectively are at the same time differentiated.

The adjacent cells in the fifth nerve centre intercommunicate, and every dental message passes through at least two central cells before it travels across the middle line, and up to the cortex cerebri of the opposite side, to end there in a small cell.

For the appreciation of pain the sensorium must be intact and the path downwards to the energised cell unbroken.

Often, however, the pain is not correctly localised. In the large number of these cases a previous history can be obtained which explains away the difficulty. For instance, a first bicuspid may cause great pain, but after devitalising the pulp, and inserting an appropriate filling, the patient ceases to suffer. A few years later severe pain may be felt in the same tooth, and yet be due to a carious molar further back. Just as it is easier for a boy to slide on a well-worn slide, so is it easier for nerve force to travel along a beaten track of pain than to arouse some healthy un-irritable nerve-cell to a state of undue excitement. In this case the message of pain travels to an adjacent cell, which, with its nerve, it energises, and the report reaches the sensorium that the old tooth aches again. To take another condition, suppose a cell energised by an exceptionally acute dental irritation, how easy for that energy to be communicated to an adjacent cell which represents a sensory area of face or scalp. It is thus we get remote pain in dental disease. But we can go one step further. If a patient complains of pain in any area supplied by the first or second division of the fifth, we may presume the source of irritation to lie, if truly dental, in the upper jaw. If the painful area be supplied by the third division of the fifth, the great occipital, small

occipital, great auricular or superficial cervical, then we search for the cause in the lower jaw, and in these presumptions we are abundantly justified. Nature is not so eccentric as some imagine her to be, for we will see in her pathological symptoms how regularly the cells belonging to the dental nerves are arranged, from that of the upper central incisor nerve above right down to that of the lower central incisor nerve below. Let us consider now a few illustrations.

A patient complained of blurred vision in the right eye, and said it had lasted for upwards of twelve years. On examination, the pupil was found dilated and unresponsive to light, thus indicating paralysis, temporary or permanent, of a few fibrils of the third nerve. On looking into the mouth a right upper molar was discovered carious. This was extracted, and three weeks later the pupil was normal and the sight perfect.

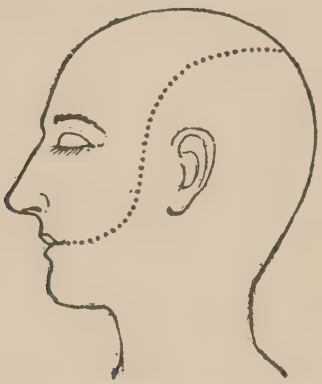
A woman, aged 45, slightly presbyopic in both eyes, came to the National Dental Hospital complaining of impaired vision in the right eye and a painful first right upper bicuspid. On closer questioning I found that her trouble was a suddenly increased presbyopia in the right eye, and that if she closed her left eye she could not accommodate her vision at all for

near objects. This patient's centre for accommodation was getting tired out, as so many people of 45 years of age unconsciously testify by their need of convex glasses when reading. The upper part of the fifth nerve centre lying alongside the accommodation department of the oculo-motor centre inhibited in this woman a cell-action that was already beginning to flag in its work. The offending tooth was removed, and the failure of accommodation of the right eye was restored to the extent that it became equal to that of the left.

Mr. Hutchinson has placed on record a case that is instructive in this connection. A woman enfeebled by nursing stated that the sight in her left eye was failing. For upwards of a month she had suffered from periodical pain in the left eyeball and forehead. The eye was watery, irritable, photophobic, and she could read only big capital letters. She gave no history of toothache, but Mr. Hutchinson extracted a carious upper molar, with the result that all the eye symptoms vanished. In this case the real cell that should have ached transmitted the message to an adjacent sensory cell, and thus energised it and its branches which supplied the eye-ball and conjunctiva.

To show the reality of remote pain, one need only point to the case recorded by M. Raymond.

A woman, aged 38, had severe pain in the head when she noticed her hair change colour from black to red and then to white, after which it began to fall off. The nerves that once transmitted the most harmless messages, were subjected to a pathological energy, so severe as to lead to inflammatory and structural changes in both nerves and nuclei. Trophic changes cause degeneration of the nerves, but this is of slower progress than actual neuritis and its results.



Remote pain from upper teeth referred to area *anterior* to dotted line ; that from lower teeth *posterior* to it.

Before dismissing upper teeth from our mind, let us remember that pain due to disease in them is to be found in any area anterior to the line passing from the angle of the mouth up to the apex of the occipital bone, separating branches of the first and second divisions of the fifth nerve anteriorly from those of the third division posteriorly.

Mr. Cattlin describes a very interesting case

of deafness in the right ear that had lasted some four days, but was cured in an hour by the extraction of a right lower molar. Cases could easily be multiplied in which earache, pain in the temple, pain behind the ear, at the side of the neck, and shooting down the arm have all been traced to disease in a lower tooth on the same side.

The inferior dental nerves arise from cells in the medulla, but when the irritant is a very severe one, the impulse is communicated to cells of the fifth lower down. Thence it travels to sensory cells of the cervical nerves, and so causes pain in the neck, shoulder, and upper extremity.

The inhibition of hearing is readily understood when one remembers the proximity of the middle root nuclei to the auditory nerve centre. This inhibition is on a parallel with paralysis of the bladder, which occasionally follows the opening up of a fistula.

Reviewing the cases of remote pain in dental disease that have come under my notice, I am struck by two facts—one, the unilateral situation of the pain, the other, the usual association of a separate area with each separate tooth. An impacted lower wisdom will not cause pain within a nostril, nor will pain behind the ear be due to a carious upper incisor.

Far and away the most frequent cause of this

remote pain is chronic inflammation of a pulp superficially. Secondary dentine and an exostosed fang are also prolific causes.

Difficulty in evolving a wisdom, alveolar periostitis, a fang roughened by absorption, a pulp putrefying in a confined space—are all common causes of the same pain. Diseases of the mucous membrane and jaw, periosteum, and tumours of the parotid and jaws may also be included.

The question of diagnosis is a wide and far-reaching one. Equally is it the duty of the dental and medical practitioner to do the best for the patient. If a dental surgeon suspect the existence of chlorosis, anæmia, hysteria, gastro-enteric troubles, migraine, gout, rheumatism, syphilis, &c., he has not done his duty until he has strongly urged his patient to consult his medical man, and that without delay.

On the other hand it is derogatory to the profession, and uncomplimentary to his acumen or honour, if a medical man continues administering bottle upon bottle of quinine and iron, while the cause of the neuralgia is a caries that goes on unchecked and untreated.

By the use of your mirror, percussion, heat and cold, biting with each tooth separately, inquiring as to the exostosis of a previously extracted tooth, &c., the source of the pain, if that source be dental, will be readily indicated. Very

often, on applying your tests, you re-light a slumbering neuralgia, and so obtain a decisive clue.

You may have wondered why I have not spoken of Trousseau, of Anstie, and of Dr. Lauder Brunton. The last named is the only one who has really trodden on our territory. Dr. Lauder Brunton appeals to the superior cervical ganglion to explain by its own perturbation an alternate distension and contraction of the blood vessels, and so the production of trigeminal pain. When any tissue of the body works—be it brain, gland, or muscle—the supply of blood is increased to the part by an inhibition of the sympathetic. Now if a sensory nerve aches, it is transmitting a considerable nerve force. This is work indeed, and necessitates more blood to the part, but surely that increased supply of blood is due to the need created by the increased work—in other words, the pain causes the flushing, not the flushing the pain. Very probably Dr. Brunton will see his way clear to re-consider his dictum, and accept the explanations of Ross, Gowers and others.

Both Trousseau and Anstie have regarded neuralgia mainly from the abstract or idiopathic point of view. Trousseau draws our attention to two tender points—*points apophysaires*—over the upper two cervical spines as an invariable

symptom in trigeminal neuralgia. Dr. Anstie made the bold assumption that all neuralgias were due to atrophy. If he were alive now he would, I am sure, be convinced of the untenability of his hypothesis.

Before discussing the treatment an interesting question might be here propounded. Why is it that a definite tooth lesion should cause a spasm in one man, whereas the identical lesion produces paresis in another?

Constitutions vary and temperaments too, and the moulding of our nerve cells is, forsooth, delicate handiwork. Our every-day experience tells us that some people are highly strung, restless, and nervous, fearful of the slightest touch of an excavator—nay, the mere use of a mirror. Others there are who seem to be marble masses of stoicism.

In the first instance the nerve cells are unstable with energy waiting to be liberated. A mere tap on a tooth in this instance may be sufficient to cause a spasm of the face. No sooner is the energy thus liberated than a fresh supply is created, and the nerve cells are filled to overflowing again. In the other instance, however, the nerve cells are kept in such perpetual check by higher cells that the check is simply accentuated, and the centre inhibited when a dental pain travels upwards.

The character of a reflex tonic spasm is observed in its analogue—the muscle of a sphincter. The contraction is wavy, and occurs in the fibres in a consecutive fashion.

Pure inhibition is productive of no permanently bad results as a rule, but one must remember that a hysterical paraplegia may become an absolute and permanent paraplegia after some years' duration.

There is only one medicine that I find of any value in the treatment of remote pain, and that is acetanilide or antifebrin. It is a drug that requires care in administration, cyanosis and urgent dyspnœa occasionally following its action. I rarely give it to those who are well on in the degenerative period of life. It suits pale, spare men and women best. It is given every two hours till the pain is relieved, in doses of two to five grains, placed on the tongue, and washed down with milk. If there be signs of a fatty heart I exhibit a mixture containing ammonia, gentian, and spirits of chloroform, with small doses of the antifebrin. Locally I advise veratria ointment and massage. Dentally I shall not pretend to speak, for you all know that part of the treatment far better than I. Abundance of fresh air, nutritious food, fresh butcher's meat, a regular daily relief of the bowels, and a little medicine, such as cod liver oil, quinine, iron—

especially the reduced iron—and the Blaud's tabloids, prepared by Burroughs, Wellcome and Co., are all valuable in their way, and in suitable cases. But be it understood no drug exists that can take the place of skilled dental treatment. If any of the remote pain remain after the full dental relief has been given, galvanism will probably complete the cure.

Gentlemen, I thank you sincerely for the patience with which you have listened to my paper.

Discussion.

Mr. C. S. Tomes remarked that he had very little to say; it was a paper which one could hardly discuss at such short notice; the various points wanted a great deal of thinking out. All that he could do was to mention an individual case which had some bearing upon two or three things which Dr. Maughan had brought forward. A patient, a lady, came to him, and was seen by himself and his colleague Mr. Baldwin, who complained of severe pain felt down the arm, but she could not more strictly localise it. Both Mr. Baldwin and he were rather puzzled to know what to do, but they decided to destroy the pulp of a suspicious tooth, with the result that the pain disappeared. In two or three years she came again, complaining of a recurrence of the pain which now seemed to be due to periosteal inflammation of the tooth originally filled. Appropriate treatment again secured a subsidence of the pain.

Two points in the case were worthy of notice. In the first place we had an instance of remote pain being referred after a lapse of years to a familiar track, and secondly, we here found two attacks of pain of a precisely similar character occurring under different pathological conditions of an individual tooth.

Mr. Cornelius Robbins thought that in general practice the cases which would illustrate the paper were of such frequent occurrence that the difficulty was really to find a case that would be of sufficient interest. He happened to be looking through one of his old note books and came across a case which occurred three years ago; it was that of a lady, aged about 26, who came to him with a history of very severe intermittent neuralgia. After three months

treatment she suffered from trismus and was therefore advised to consult a dentist. He found the wisdom tooth very much inflamed, and advised its removal; the patient was given gas, and she, as well as the doctor present, supposed the whole tooth to have been removed. Seeing that she had a return of the neuralgia, and in just as severe a form, it was supposed to be constitutional. Another year went by and she was advised to go to Mr. Robbins, who found the second molar had no antagonist and stood very high, and behind that there was a very puffy condition of gum. She had in addition to her other troubles pain in the right arm and severe eczema. He probed behind the second molar suspecting a buried wisdom tooth, and found that a greater part of the tooth was there. He advised her to allow him to remove it, to which she consented. Under the root were found evidences of abscess. The trouble entirely subsided after about six weeks, and the eczema also cleared away, but dental treatment found but scant acknowledgment at the patient's hands, who attributed the cure to a "new ointment" she had been using.

Mr. W. A. Hunt (Yeovil) wished to remind the Society that some few years ago a paper similar to the one to which they had listened was read by Mr. Power, and a most interesting paper it was. Following that at some distance, they had a paper read by Dr. Job Collins, who was of opinion that eye troubles could very seldom be traced to dental causes. He (Mr. Hunt) could not say that Dr. Collins' arguments were very convincing to him, and he should have been glad if he could have been present that evening. He would say that he regarded Dr. Job Collins' paper as a very valuable one, because it would make them look round and see what ground they had for the faith that was in them; he said for the faith that was in them, because these cases of remote pain in conjunction with dental trouble were so frequently occurring, that they could not but regard them as cause and effect. He would like to mention a case in the late Mr. Sercome's practice. The patient, a female, was suffering a good deal of neuralgic pain in the neighbour-

hood of the uterus, and she also had a tooth which bothered her very much; the instant the tooth was removed she had most excruciating pain, which lasted only a few minutes, and never returned.

Mr. Albert believed that Mr. Power's paper, as also Dr. Job Collins', was on oculo-dental reflexes only. He (Mr. Albert) was one of the unfortunate ones who agreed with Dr. Job Collins. He had only had two cases of possible oculo-dental reflexes, both of which might reasonably be accounted for without reference to the teeth. The first, a lady with ptosis came to him, and he removed a tooth, after which she recovered; but as she was at that time put on anti-syphilitic treatment, the diagnosis became doubtful. A second case, that of a child who had phlyctenular ulceration in one eye; she had been to an ophthalmic surgeon, and was treated for some time. She was then sent to Mr. Power, who attributed the condition to a carious upper pre-molar. The tooth was removed and the trouble cleared up; it was cited as a case of oculo-dental reflex. Only during the last week he had had two cases which bore on the paper which they had listened to: one a man aged 35, who suffered from frontal headaches, and also pain in the chest, which, coming on after meals, indicated dyspepsia; he had an upper molar which was carious, and Mr. Albert removed it, when the pain in the chest was much alleviated. Another case was one of a girl, who consulted him a day or two since, suffering from difficulty in swallowing; she was anæmic, but otherwise fairly well conditioned. Her trouble, she said, was due to two molars very extensively diseased. He took out the teeth, and she reported that she was absolutely free from pain, and able to swallow with ease. There was one other point he should like to allude to, viz., the occurrence of what might be termed assumed pain. Instances of hysterical toothache were not rare, and pain in various parts of the body, with perfectly sound teeth, would often succumb to a proposal to take out several teeth.

Mr. Albert also wished to mention that urethritis had been known to occur synchronously with the eruption of teeth—a fact which was borne out by similar experiences in veterinary practice.

Dr. MAUGHAN said that he had very little to reply to, but wished to thank the members for the experiences given in the discussion. In connection with oculo-dental symptoms, he had paid a good deal of attention to one line of enquiry, viz., whether failure of sight could be traced to dental irritation; but hitherto he had never been able to obtain affirmative evidence.

A formal vote of thanks was given to the reader of the paper, and those who had brought forward casual communications.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

March 6th, 1893.

MR. R. H. WOODHOUSE, M.R.C.S., L.S.A., L.D.S.

VICE-PRESIDENT, IN THE CHAIR.

THE Minutes of the previous meeting were read and confirmed.

Mr. T. A. ROGERS requested the permission of the Chairman to make a slight correction in what he was reported to have said at the Annual Meeting. He wished the word "ultimately," to be substituted for the word "independently," so that the corrected sentence would read: "I never concealed the opinion that the Odontological Society must have its own home ultimately."

Messrs. H. J. MESSENGER and F. W. BARRETT signed the obligation book, and were formally admitted as members.

The following nominations for Non-resident Membership were read before the Society :—

DURWARD, P. STEWART, L.D.S.Edin., 127, Mayfield Road, Edinburgh.

FRASER, JAMES LESLIE, L.D.S.Edin., 5, Castle Street, Inverness.

SHIACH, GORDON REID, L.D.S.Edin., 1, North Guildry Street, Elgin.

Smith, Arthur Hopewell, L.R.C.P.Lond., M.R.C.S. Eng., L.D.S.Eng., Lindum House, Boston, Lincolnshire.

Stewart, James, L.D.S.Edin., 19, Princes Street, Perth.

The following gentlemen were balloted for, and unanimously elected Resident Members:—

Baly, Chas. Francis Peyton, L.D.S.Eng., 140, Harley Street, W.

Blain, Edward John, L.D.S.Eng., 35, Moore Street, Chelsea, S.W.

Clarence, Thomas Herbert, L.D.S.Eng., Chase Side, Enfield, N.

Gardner, Ernest, L.D.S.Eng., 139, Victoria Street, S.W.

Hayward, Henry Saville, L.D.S.Eng., 12, St. Anne's Terrace, Circus Road, St. John's Wood, N.W.

Northcroft, George, L.D.S.Eng., 4a, Portman Mansions, W.

Preedy, Edward John, L.D.S.Eng., 1, Hanover Square, W.

Smith, Edward F., L.D.S.Eng., 176, Brixton Road, S.W.

Stevens, Herbert John, L.D.S.Eng., 72, Jenner Road, Stoke Newington, N.

Tisdall, Charles J., L.D.S.Eng., 2, Heathfield Road, Acton, W.

Non-resident Members:—

Gabell, Douglas Phillimore, L.D.S.Eng., 47, East Street, Brighton.

Goodman, William Henry, L.D.S.Eng., Palace Gate, Exeter.

Hope, Arthur Curling, L.D.S.Eng., Rockholme, Hastings.

Hope, Hubert L., L.R.C.P.Lond., M.R.C.S.Eng., L.D.S. Eng., Rockholme, Hastings.

Martin, Gavin, L.D.S.Eng., 7, Manningham Lane, Bradford.

Weston, Ernest, L.D.S.Eng., High Street, Ventnor, Isle of Wight.

The Librarian reported that he had received—*The Journal of Anatomy and Physiology*, for January, 1893, *The*

Journal of Pathology and Bacteriology, February, 1893, *The Proceedings of the Royal Society*, *The List of Fellows, Members, and Licentiates of the Royal College of Physicians of London*, the *Calendar of the Pharmaceutical Society* for 1893, and "The Mechanics of Daily Life" presented by Mr. Brunton.

Mr. W. Hern brought forward two casual communications—(1) a case of uni-lateral paralysis of the soft palate; (2) some appliances for facilitating the operation of pivoting.

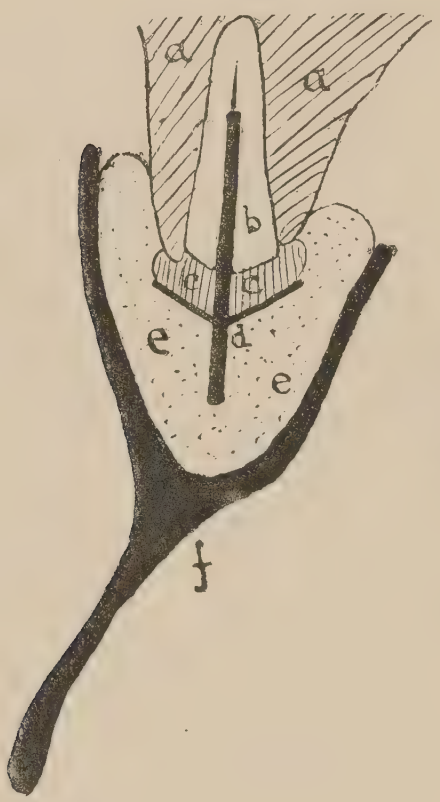
In the case of uni-lateral paralysis of the soft palate he regretted to say that the patient had failed to attend the meeting, as he thought the great interest lay in being able to see the patient and hearing her speak. The tone of voice and method of speech were so similar to ordinary cleft palate that it was mistaken for such by the Secretary of the Surgical Aid Society, who sent her on to the Dental Hospital.

The patient, a woman aged 20, suffering from paralysis of the soft palate on the right side, applied at the Dental Hospital to see if anything could be done to render speech more distinct. She also complained of great annoyance from fluids escaping through the nose when drinking. On looking into the mouth the right side of the velum was seen to be drooping and pendulous, and also insensitive to touch. The symptoms dated from an attack of scarlet fever at the age of 3 years. Feeling that nothing could be done for her by mechanical means, he was anxious to see if anything could be suggested as a means of palliation at a general hospital; accordingly he took her to the Middlesex Hospital, and put her under the care of the physician in charge of the Electrical Department.

Dr. Wynter's notes were as follows:—Aspect of patient is suggestive of congenital syphilis; lower lip everted, and dribbling present; right side of soft palate paralysed so that air and fluids escape by the nose. There is clumsiness of movement of right arm and leg, and knee jerk on this side is exaggerated. Pupils act to light, but are unequal. Palate re-acts to fourteen cells; Faradic contractibility ab-

sent. Patient is the youngest of three, and one of twins. The condition is probably due to thrombosis of a cerebral vessel with hemiplegia during childhood.

Mr. Hern next showed and described a set of instruments for preparing roots for pivots. He did not claim originality for them; they were merely modifications of pre-existing forms. They all knew how important it was, in preparing roots for pivots, to cut the anterior surface of the root sufficiently under the gum margin without injuring it; many



(a) Alveolus and Gum.
(b) Root.
(c) Gilbert's Gutta Percha.
(d) Pin and Root-tray.
(e) Godiva.
(f) Pewter Tray.

instruments had been used for this purpose—files, corundum discs, &c.—but they all produced a certain amount of irritation and wounded the gum margin; these instruments cut the root well under the gum without injury, as they cut on the *flat surface only*, the periphery being smooth. They were made in sizes to correspond to the diameter of the root they had to cut, and not only cut under the gum margin, but left the root such a shape that an artificial

tooth may be easily fitted to it. Mr. Hern further exhibited an appliance for taking a good model of the root after it was cut. It consisted of a small copper shield about the diameter of the root, soldered to a guide pin. When the root is properly shaped and fully prepared he takes one of the shields or root trays and bends it to the angle of the root, and then puts some softened gutta percha on to the upper surface. This is then pressed on to the root and the gutta percha forced up under the gum. An impression with the shield *in situ* is then taken with ordinary composition, and in this way an excellent model results.

Mr. Brunton, in describing a root canal reamer which he had made, alluded to the difficulty experienced in preparing canals for filling, for instance, in the buccal roots of upper molars. He had contrived a small instrument which acted as a reamer and simplified the operation considerably. It consisted of a piece of pianoforte wire sharpened on three sides by a corundum disc, having a long fine point, and when required for use inserted in a chuck running in the engine.

He also showed a new disc carrier, which may be rotated either to the right or left without any fear of the disc coming off.

He lastly exhibited a spirit lamp with a platinum coil attached, which by reducing the temperature of the flame, prevented the sweating of foil or cylinders in annealing.

The Secretary, for Mr. Trude Fripp, presented to the museum a couple of models showing transposition of canines. In one there existed the peculiarity that the direction of the axis of the tooth from cusp to apex of root was backward, so that the tooth would appear to have been developed somewhere in the region of the first molar.

The Chairman remarked that these cases were very often due to the retarded development of canines, or the congenital absence of laterals.

Mr. Baldwin communicated a method of repairing bridgework and Richmond crowns within the mouth. After several

unsuccessful experiments with a small blow-pipe flame in the mouth, he tried the simpler plan of using an ordinary "soldering-iron" of small dimensions, with solder known as "pearl" solder, which fuses at a very low temperature.

He takes a suitable tooth, and backs it with thin or ordinary backing — whichever suits the case — and then "tins" it, afterwards "tinning" the gold or platinum back which is still in the mouth; having the work quite clean, the parts are touched with the ordinary soldering solution (Zn. and HCl.) and then the solder placed at the junction of the two backings by means of the hot iron, and almost instantly the solder runs through and fixes the tooth tightly in position. The mouth is kept dry by the rubber dam, if possible, asbestos twist and cloth being packed around the part where the soldering is to take place as a protection.

He finds this process applicable in other ways; for instance, a few days ago he had a lower bicuspid which was fractured longitudinally through the pulp canal; he fitted a gold band round the tooth (to which he had previously attached two gold catches), and then by means of a Ladmore-Brunton clamp, screwed the band up tight, soldered it in position, and afterwards drilled out and filled the pulp canal.

The Secretary was then called upon to read the paper of the evening in the absence of the writer.

Pathological Conditions of the Dental Pulp.

By George W. Watson, L.D.S.Edin.

Mr. President and Gentlemen,—Before saying anything about the pathological conditions of the pulp, allow me to say a few words in regard to the histology of this organ. The pulp occupies the central portion of the crown of the tooth and the root canal or canals, terminating at the apical foramen. It is largely endowed with nerves and blood vessels, which terminate in loops, forming a fine plexus and network at the periphery of the pulp. The pulp matrix is semi-gelatinous, and is thickly covered with cells (odontoblast), connective tissue, oval and round cells. Those cells, both in the bulbous and root portion, are more numerous at the periphery, and whereas they lie without arrangement in relation to each other in the coronal portion of the pulp, in the root portion the long axis of the cells is parallel with the direction of the pulp canal. The anatomical relations of the pulp, and the fact that it is boxed up in a rigid cavity, render it very susceptible to pathological conditions when irritated or inflamed, and I very much doubt

whether it ever assumes a healthy condition again after an attack of acute inflammation.

Pathological conditions of this organ might be classified into (1) Irritation of Pulp; (2) Acute Pulpitis; (3) Chronic Pulpitis; (4) Abscess of Pulp; (5) Hypertrophy, Atrophy, and Degeneration; (6) Secondary hard Formations.

(1) Irritation of the pulp is usually consequent on some slight injury to the enamel or subjacent dentine, either by caries, abrasion, or erosion; or the conduction of thermal changes through a metallic filling, and hypersensitive dentine. This sensitiveness to changes of temperature, it must be remembered, is one of the normal functions of the pulp. In such cases the irritation is conveyed to the pulp by means of the dentinal fibrils, as a result of which there is produced a certain amount of hyperæmia, or determination of blood to the part opposite the lesion; this hyperæmia may only cause a slight distension of the blood vessels, or result in extensive aneurismal dilatation of the vessels, without, however, any alteration of the tissue elements of the pulp. If the condition persists, or happens frequently, the vessels fail to contract owing to partial paralysis of their vaso-motor nerves, and a permanent distension of their walls results, ending in exudation of their contents, and the production of acute inflammation. If, on the other hand, the irritation

is removed, the pulp assumes its normal condition again. The pain caused by irritation of the pulp with hyperæmia is sharp, intermittent, and paroxysmal in its character, its location being commonly in the neighbourhood of the ear. The patient frequently has difficulty in locating the pain, or refers it to the wrong tooth. In all cases of irritation of the pulp which I have examined, there have been present small nodules of secondary dentine, which may have something to do with the neuralgic pain associated with this condition. Pulp irritation and hyperæmia may be in certain cases a resultant of pulp exposure, but in such cases the pulp speedily becomes acutely inflamed, and eventuates in suppuration of the organ.

(2) Acute pulpitis is pretty common as a sequence of long-continued irritation, but is much more frequent as a result of pulp exposure from caries, &c.

In some cases the inflammation is limited in extent, only a portion of the pulp being implicated; on examination of such a pulp it will be found in the neighbourhood of the exposure of a bright red colour, shading off from the periphery to the centre; the blood vessels are numerous and distended with blood, the nerve bundles and connective tissue cells in neighbourhood of focus of inflammation present evidences of structural

changes, while a molecular cloudiness may be noticed, due to the presence of numerous fat granules. As the disease extends, the normal elements of the pulp become to a larger extent replaced by inflammatory exudates and fat cells, and the distended blood vessels, especially at the apex of root or roots, are liable to be strangulated, resulting in necrosis of the organ; thrombosis of the main vessel may also be a causation of necrosis.

Another result of acute pulpitis may be suppuration, wherein the exudation cells and tissue elements of the pulp proliferate extensively and become converted into pus cells, accompanying which condition there is usually fatty metamorphosis. It is a curious fact that the odontoblast cells in acute pulpitis persist to the last, and are only destroyed when suppuration ensues. In some cases of very acute pulpitis with exudation, the colouring matter of the blood is forced into the tubules of the dentine, producing a red staining. This staining is sometimes seen as a sequence of the application of arsenic to the pulp, when acutely inflamed. My old master, Dr. Orphoot, first drew my attention to this fact many years ago, since which time I have come across, and possess, several specimens.

(3) Chronic pulpitis, as a result of exposure, is met with more frequently than the acute, and is

very often overlooked by the patient, owing to the comparative immunity from pain associated with it. This form of disease is less amenable to treatment than even the acute. The pulp at point of exposure, and for a slight depth beyond the surface, is highly vascular and red, and from the surface is given off a serous or purulent fluid of a disagreeable phosphatic odour; beyond the inflamed portion the pulp will be seen to be quite normal in its character. In the neighbourhood of the inflamed part the odontoblast cells will be found atrophied and rapidly disappearing as the ulcerative process extends. Inflammatory degeneration ensues, and gradually reduces it to a greyish yellow shrivelled mass, or, under favourable conditions, the chronic form may take on acute disease, ending in suppuration or gangrene. It is very probable that micro-organisms have something to do with the ulceration incident to chronic pulpitis, but this is a subject which requires careful investigation before anything definite can be said.

(4) Abscess of pulp has already been mentioned as a sequence of acute inflammation. Its occurrence is usually coincident with exposure of the pulp to the fluids of the mouth, which, it must be remembered, nearly always contains pyogenic organisms. It may commence, as in chronic pulpitis, in a pus-secreting inflammation, and

gradually invades the deep tissues of the pulp, having a tendency to penetrate the pulp in the direction of the main blood vessels.

In the neighbourhood of the focus of suppuration the blood vessels will be found dilated into ampulæ; the odontoblast cells are gradually undermined and destroyed, while the nerves become indistinct, and speedily disappear. This destructive process may go on till the whole of the pulp becomes gangrenous, or suppuration may stop short and fatty degeneration ensue.

Dr. A. C. Hugenschmidt of Paris has recently drawn attention to a form of abscess of the pulp which he calls partial suppurating pulpitis, which is always associated with chronic alveolar abscess. The tooth may not be carious, or only to a slight extent, is darker in colour than the normal tooth alongside of it, and there is a persistent alveolar abscess over the apex of the root. If the pulp chamber of such a tooth be opened into, the organ will be found fully alive. According to Dr. Hugenschmidt, such pulps have on their coronal or root surfaces a small ulcer which secretes pus, and this travels along the external portion of pulp, and reaches the apical foramen—usually in these cases very large—and finds its way to the surface like an ordinary alveolar abscess. A good many years ago I had just such a case, which puzzled me very much. A lady called on me

with a slightly discoloured central incisor free from caries, and which had a discharge over the apex of the root. I immediately began to drill into the pulp at the back of the tooth, but found to my astonishment that as I got further in the tooth became more and more sensitive, and I had to apply arsenic to destroy it; unfortunately, the pulp was not examined after its removal. Several authors mention the fact of small localised abscesses being found in the substance of the pulp, but no one, so far as I am aware, except Dr. Hugenschmidt, has called attention to the peculiarity of this form of abscess associated with the presence of a live pulp.

(5) Hypertrophy of the pulp, as a result of chronic pulpitis with exposure, is of common occurrence. It consists of an insensitive hypertrophic growth of the pulp which bulges through the opening into the pulp chamber, proliferating and filling up the carious cavity with a red fleshy mass. The origin of such growth has usually been attributed to the irritating effect of the saliva, but I am more inclined to think that the products of the numerous micro-organisms present in such cases, and also combined with the saliva, have more to do with it. There is an entire absence of nerves, which seem to atrophy; and according to Salter, the blood vessels are enormously dilated into ampulæ. I have been unfortunate in not

being able to make this out in the four or five hypertrophied pulps sectioned. A hypertrophied pulp differs entirely in its histological structure from the normal pulp, being principally made up of multi-nucleated oval or round cells, analogous to granulation cells, with a greater or less amount of interstitial fibrous tissue. The external surface of such growths is sometimes covered with squamous epithelium. Several authors—J. Tomes, Wedl, &c.—mention the fact that hypertrophied pulp sometimes becomes calcified.

I met with a case which I can only attribute to this origin some years ago. A boy of 14 had a $M^{\frac{9}{1}}$ having a pretty large carious crown cavity with an exposed and hypertrophied pulp; there was some difficulty in getting arsenious acid applied, owing to an obstruction. Next day I found there was a square block of hard tissue lying over the roof of the pulp chamber, but not filling the carious cavity quite up; the pulp had been exposed at one side and proliferating had filled up the space all round between the block of hard tissue and the cavity; the hard tissue I broke away with an excavator, and, as you will observe from the slide, it has all the appearance of osseous tissue.

Degenerations of the pulp as a sequence of chronic inflammation, and as a result of sene-

scence are not uncommon, and might be divided into fatty degeneration, areolation, fibroid, and calcareous degeneration.

Fatty metamorphosis, and other degenerative changes in the pulp generally take place as the result of sub-acute or chronic pulpitis, and are always an indication of diminished vital activity in the organ. A pulp thus affected is reduced in volume, somewhat opaque, and of a yellowish red or grey colour, and feels unctuous to the touch. As the process progresses the sheaths of the nerves, the coats of the blood vessels, and to a certain extent the parenchyma and cells of the pulp, all undergo fatty metamorphosis, and scattered through the whole of the organ are numerous fat globules, which obscure its ultimate structure when examined microscopically. This condition of fatty degeneration, which in a young patient might be a sequence of chronic pulpitis from pulp exposure, occurs in old people as a result of those degenerative changes accompanying senescence. Such pulps do not give rise to abscess or cause any trouble unless exposed to the fluids of the mouth for some time.

Areolation of the pulp seems to be a somewhat rare affection, and develops as a result of chronic inflammation. The pulp is found shrivelled up and is much reduced in size so as to resemble a thin membrane; it is smooth in ap-

pearance, and dark brown or reddish in colour. The cells and general histological appearances of the pulp are entirely changed, a reticulum of fine fibrous tissue is developed, and scattered through the mesh-work of fibres are numerous oval cavities which are supposed in life to contain fluid; the condition may only affect part, or the whole of the pulp.

Wedl mentions another pathological condition which seems to be somewhat analogous, namely, sclerosis. Tense cord-like bundles of connective tissue interlace and form sharp angles with each other, between the meshes of which here and there fat granules occur; as the pathological condition advances, the bundle of nerves and other normal elements of the pulp atrophy and shrivel up.

Fibroid degeneration of the pulp is found chiefly in the worn down teeth of elderly people, and occurs as a sequence of defective nutrition of the pulp; there is an abnormal production of fibrous tissue developed, no doubt from the connective tissue elements of the pulp, the tissue occurring in bundles, or as a network, while the nerves, cells, and blood vessels atrophy, and if the process is unhindered, the pulp shrivels up and becomes dead, or suppuration may attack and destroy it. Associated with this pathological condition tortuosity and distension of the vessels

are usually present, tending to partial strangulation, and the formation of a lower type of tissue as a result of decreased nutrition. The various conditions mentioned in the degenerative changes incident to the pulp may in some cases be combined. Fatty metamorphosis may be combined with calcification, fibroid, or calcareous degeneration.

Calcareous degeneration is very frequently associated with fibroid or fatty degenerative conditions of the pulp, and must not be confounded with the ordinary calcified pulp nodules. It consists of deposits of calcareous salts in the connective and other tissues of the pulp, analogous to what obtains in other tissues and organs of the body. The concretion is a sequence of inflammatory changes in the pulp, and is found in shape of irregular semi-transparent, oval, round, or cylindrical masses, very often adhering to the blood vessels or trunks of nerves. They are rugose on the surface, and in this respect differ entirely from the nodular calcified masses found in the pulp, which are comparatively smooth. These calcareous masses dissolve in dilute acid with the evolution of, probably, CO_2 gas.

Their chemical composition is supposed to be principally phosphate and carbonate of lime. As a rule this form of calcareous concretion is more frequently found in the radical portion of the

pulp than in the crown. Such pulps containing much of this deposit when dry, are extremely brittle, and are readily cut through in sectioning for microscopic investigation. The pathology of such deposits in the pulp is pretty evident. Lime salts are deposited from the inflammatory exudate and form granules which increase in size at each exacerbation of the disease, till they form the usual irregularly shaped concretions scattered through the tissues of the pulp. Accompanying this calcareous deposit there is usually considerable dilatation and thinning of the walls of the principal blood vessels and atrophy of the nerves. It appears to me that such deposits have their origin in sub-acute inflammatory conditions, the process eventually becoming chronic in its character.

This pathological condition of the pulp I am convinced frequently originates severe neuralgic pain; one case in illustration. Some years ago a lady called on me who had been suffering for some time from severe neuralgic pains. In a second lower pre-molar, the pulp was not exposed, but had only a thin layer of dentine over it. I attempted without success to soothe it down; one day it would be all right, but the next it might be as bad as ever, so the patient eventually insisted on its removal. On examination of the pulp I found in the pulp substance of root nume-

rous calcareous cylinders, which, I have no doubt, were the origin of the irritation and the cause of the neuralgia.

(6) Secondary hard formations in pulp cavity. It is still a little doubtful as to whether these formations are entitled to be classified as pathological or not; however, I think there is considerable evidence that in most cases they are truly pathological. Secondary formations might be classified into (1) Dentine of repair. A new and somewhat regular growth of dentine adherent to the pulp chamber and deposited opposite some lesion of the tooth, such as caries, abrasion, or erosion. (2) Dentinal tumour or odontome. An irregular growth of dentine growing from the pulp chamber by a pedicle, the tubules of primary dentine being continued into the secondary growth. (3) Nodular calcification of the pulp. Irregular masses of calcified dentine, with very small and tortuous tubules scattered through the tissues of the pulp. (4) Osteo-dentine. Irregular dentinal formations containing both the lacunæ of osseous tissue and dentinal tubules.

Dentine of repair was recognised and known more than 100 years ago, but only as a result of abrasion, and is interesting to us as exhibiting the *vis medicatrix naturæ* of such tissues as the tooth pulp. Dentine of repair is produced when, as a result of disease or injury, a portion of the

protecting cap of enamel is removed, thereby exposing the underlying highly sensitive dentine to irritation. This impression is doubtless conveyed to the pulp by the dentinal fibrils exciting the odontoblast cells to renewed productivity and the development of compensatory tissue; in some cases, however, no secondary deposit takes place. The amount of this tissue deposited is proportional to the extent of the injury at any particular part, and registers its progress by distinct laminations. There is always a distinct line of demarcation between the primary and the secondary dentine, and on maceration the repair tissue frequently separates from the walls of the pulp chamber. We are in the habit of thinking that a deposit of secondary, or repair tissue is the best that can happen after capping an exposed pulp, but I am afraid it is just the beginning of the end, as the organ speedily succumbs under the influence of this deposit, and the pulp becomes necrosed.

Dentinal tumour or odontome.—This sort of growth is found less frequently than the other varieties, and varies very much in form, incidence and position. In some cases they grow from the roof or sides of the pulp chamber, or between the entrance to the roots in multiple-rooted teeth. They originate at a time when the walls of the pulp chamber are in process of calcification, the

anatomical structure showing this, inasmuch as the tubules of the new tissue are in direct continuity with the primary dentine. The boundary layer is distinguished by the uniformity of the tubules extending from it, while the tubules of the new formation are very erratic in their course, and meet those of the primary tissue at an acute angle, and here and there at nearly right angles.

The usual form assumed by these growths is oval or round, but I have a beautiful specimen of a stalactitic form which was found in a carious lower molar, the subject of very intense neuralgic pains, growing from the roof of pulp chamber. This pathological condition may be found in perfectly sound teeth as well as in those the subject of some lesion, and their presence in the pulp chamber may not cause any inconvenience; but let the pulp become inflamed and a different state of matters will prevail. The pulp, when the subject of inflammation, expands like other tissues, and being forced against these growths, originates very severe neuralgia, as mentioned by various authors. I have come across several such cases where, on examination afterwards, this condition was found present, associated with very severe neuralgic pains, the case of the stalactitic form already referred to being one of them.

Nodular calcification. — Scattered nodules of dentine are very frequently found present in

the pulp; more particularly is this the case when the tooth is the subject of abrasion, erosion, or caries. At an early stage of the process dark outlined cell-like bodies, probably calcoglobulin, will be found scattered through the substance of the pulp, by the multiplication and coalescence of which there is produced those multiform-shaped nodules. In size they vary much, in some instances microscopic, in others filling up nearly the whole of the pulp cavity or root canal. In form they are flattened, round, wedge-shaped, conical, berry-like or warty. A good specimen of pulp nodule presents to the naked eye a yellowish amber colour, a certain degree of transparency, and a hardness nearly equal to that of dentine, having a rounded outline, and is generally nodulated. They present no regularity in their histological structure, showing sometimes a concentric arrangement; at others they are composed of irregular masses of secondary tissue with very erratic and contorted tubules; they occasionally exhibit the remains of vascular canals. In some cases when the whole of the pulp is calcified, we find small isolated and uncalcified portions of the pulp remaining, which are apt to prove troublesome, especially in roots, when attempting to devitalise. The presence of tubules in these growths does not necessarily mean that we must have odontoblast cells for their development.

In a large number of cases these cells are destroyed or atrophied, in which condition, I have no doubt, the connective tissue cells of the pulp generate both tubules and the calcified mass. Like other varieties of secondary formation, I am inclined to include nodular calcification as a pathological condition also, as it occurs in teeth nearly always affected by caries, abrasion, or erosion, and as a result of pathological conditions of the pulp, due to the above-mentioned lesions.

Osteo-dentine, as its name implies, is a form of secondary dentine, embracing the characteristics of both bone and dentine. It is found in the pulp lying loosely or attached to the walls of the pulp canal, in the shape of round or irregular nodules, and is developed from the connective tissue of the pulp. It usually contains blood vessels, round which there are sometimes formed a concentric arrangement of the tissues analogous to that of the Haversian system in bone, agreeing also with this tissue in the presence of lacunæ. Some authors classify pulp nodules under osteo dentine, whether they contain osseous tissue or not in their structure. I think it better to apply the term, osteo dentine, to tissues which exhibit all the characteristics of both bone and dentine. This form of secondary formation is somewhat rare, and I only obtained

one good specimen out of 1,000 teeth examined while investigating this subject, some years ago.

A number of years ago I gave a paper before the Odonto-Chirurgical Society, on "Secondary Formations in the Pulp Cavity," and from the tabulated list drawn up at that time, the percentages in 1,000 teeth of the different varieties of secondary formations are tabulated; of course it is only a rough approximate. Out of 1,000 teeth examined, there were 768 carious, 135 were worn down by abrasion, forty-nine of which had no appearance of calcific changes in the pulp, the other eighty-six having it present to a greater or less extent; seven were grooved by erosion, four of them having repair tissue present, the other three had none; thirty-five were sound, or what would usually be termed sound, eighteen of which were unaffected by calcification, the seventeen having one or other of the varieties of secondary formation present, while of dentinal tumour there were seventeen. On enumerating those which had, and those which had no calcified tissue present, it was found that those without numbered 564, while those that had, numbered 432; the proportion, therefore, being 43·2 per cent. with calcification, and 56·4 without.

Discussion.

Mr. F. J. Bennett expressed his regret that the author of the paper was not present. So large a field had been covered, and so hurriedly was each point dealt with, that it was very difficult to discuss it properly.

One remark of the writer's he was inclined to take exception to, and that was, that the formation of secondary dentine after abrasion or attrition—dentine of repair—was a sign of the beginning of the end. He thought the author must have confused dentine of repair with intrinsic calcification of the pulp. If secondary dentine was formed opposite a spot—very irregular though it might be—there was no loss of continuity between the hard tissues, the new formed tissue was closely applied to and in continuity with the primary dentine. Then beneath that we found the pulp perfectly healthy, and we got normal regular dentine formed.

He was not of opinion that pulp nodules did much harm to the pulp, but it was a sign that the pulp was already undergoing pathological change, and that might be considered to be a sign of the beginning of the end, though he would not at all like to say that dentine of repair was so; indeed, if we took the case of the teeth of rodents or elephants (with their continuous growing pulps), no sooner were they erupted than they began to wear away and secondary dentine formed; and though this was the beginning of the end, the end was a very long way off. He would like to allude to one very interesting point, and that was, in cases where there was an abscess over a tooth and every sign of a dead tooth present, when on drilling into it we were mortified to find the pulp alive; he would be very glad to hear from the members of the Society some explanation on this practical point.

Mr. C. S. Tomes was afraid he had not much to say concerning the paper. Mr. Bennett had already touched upon one or two of the most important points. It seemed to him that the paper went over a good deal of ground, and he had not been quite able to follow all the illustrations that were shown. Some conditions that were described as pathological appeared to him to resemble those of normal pulp. We did not understand the normal pulp very well, as we were constantly seeing specimens which, whilst quite normal, presented appearances which were not familiar.

The question of determining what constituted congestion of the pulp was one of difficulty, for whilst the condition was easily recognised with the naked eye owing to its colour, yet under the microscope the task was by no means so simple. He felt that some method was wanted for measuring the comparative sizes of blood vessels when normal and when inflamed.

Mr. Mummery agreed with Mr. Tomes' remarks, and felt sorry that the pulps which had been illustrated that evening had not been stained for micro-organisms.

Mr. Hopewell Smith was rather puzzled about micro-organisms in connection with hypertrophy of the pulp, and did not quite understand how the condition was brought about.

Mr. Baldwin said the question which interested him most was how far a pulp exposed by caries was infested by micro-organisms. It was generally understood that those pulps which were traumatically exposed were free from micro-organisms, and those which were exposed by caries were infested by them. Was it possible by antiseptic dressings to get them in a thoroughly healthy condition?

Mr. Ashley Barrett would like to ask the author of the paper more with regard to the staining of teeth. So far as his observations went the discolouration might be found in choleraic patients, or as the result of a blow or the application of arsenious acid. He would like to ask Mr. Watson as to the precise cause of the staining.

The Chairman: Mr. Watson will see the report of the discussion, and it is quite possible he will be able to prepare

some form of reply to the various questions which have been suggested this evening. I think it will be the most satisfactory way of finishing up this discussion, for it is obviously incomplete without Mr. Watson.

Mr. S. Spokes said in that case he would like to hear from Mr. Watson an expression of opinion as to the process of calcification of the exudates; and with regard to what are called pulp stones, it would be interesting to know whether Mr. Watson considered that the process of calcification took place around blood vessels, or whether the presence of the blood vessels in these secondary deposits of dentine was accidental.

A formal vote of thanks was accorded to Mr. Watson for his paper, and to those who had brought forward casual communications.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

April 10*th*, 1893.

Mr. BOWMAN MACLEOD, L.D.S.

President, in the Chair.

The Minutes of the previous meeting were read and confirmed.

The following signed the Obligation Book and were formally admitted as Members :—Messrs. W. T. Trollope, C. F. P. Baly, Edward J. Preedy, Ernest Gardner.

The President announced that he had received obligation forms, duly signed, from the following gentlemen :

Gabell, D. P., of Brighton.
Goodman, W. H., of Exeter.
Hope, H. Curling, of Guildford.
Martin, G. W., of Harrogate.
Stoner, Harold, of Brighton.
Weston, Ernest, of Ventnor.

and he declared them admitted as Non-Resident Members of the Society.

Mr. Frederick William Richards, L.D.S.Eng., of 27, Paradise Street, Birmingham, was elected a Non-Resident Member.

The Librarian reported that he had received since the last meeting, in addition to the usual journals and periodicals, (1) the *Transactions of the Seventh International Congress of Hygiene and Demography*, (2) the *Transactions of the Medical Society of London for* 1892, (3) "Les Accidents de la Première Dentition," by P. Poinsot, presented by the author.

The Curator said a photograph had just been placed in his hands by Mr. Sidney Spokes, it was of a school boy who exhibited asymmetry of the cranium and jaws.

Mr. R. H. Woodhouse, with reference to the photograph, thought it would be interesting to obtain some history of the case; it occurred to him that the head might have been injured by the use of forceps at the time of birth, and so produced this peculiar conformation of the head.

The President then announced that the evening was to be devoted entirely to Casual Communications.

Mr. R. H. Woodhouse on a Case of Amputation of a Lateral Incisor Root for the Cure of a Chronic Abscess.

The patient, a lady aged 33 years, had a right upper lateral incisor which had been dead for many years, and the canal filled; there was a chronic abscess over the apex, and every attempt to relieve this met with but partial success.

The tooth being valuable, he decided to remove a portion of the root in the neighbourhood of the abscess. The sinus was enlarged by dressing with cotton wool and carbolic acid, when the upper portion of the fang could be distinctly felt. After opening the sinus he passed a German fissure-bur in, and felt for the portion of the root where the periosteum was still adherent; having determined this as near as possible, he proceeded to cut off the apex, which fell back into the abscess cavity; the cavity was then

washed out and dressed three or four times with iodine liniment. He saw the patient three weeks after the operation and the wound had healed up completely, leaving only a little dimple on the gum. He had recently seen the patient again—nine months after the operation—and the parts were quite healed. On very close examination he could only find a very fine sinus, but one that caused no inconvenience whatever. Some gentlemen might say that the best treatment would have been to remove the tooth, cut off the apex, and then replace it, but he preferred the less heroic course. He had with him the amputated end of the fang, and it seemed surprising that so small a portion could cause such discomfort and so large an amount of pus. He would like to add that the canal had been filled some years with carbolic acid and oxide of zinc, so that there was no further good to be obtained from dressing the root; the only course open, therefore, was to amputate the apex of the root, and he would feel inclined to treat similar cases in like manner. The iodine liniment was four and a-half times as strong as the tincture, and he found it very useful for dead teeth as well as chronic abscesses.

Mr. Curnock had a case in which the treatment was somewhat similar to Mr. Woodhouse's, the cause, however, being different. He had been unable to completely devitalise the pulp of a second upper bicuspid, and repeated the dressings from time to time to no purpose; at last the patient got tired and wished the tooth extracted. On thinking the case over, he came to the conclusion that there must be a small curvature at the end of the root which prevented him from devitalising the whole of the pulp, and therefore consented to take the tooth out on condition that he might replace it. On extracting the tooth the suspected curvature was found; holding the tooth in a napkin saturated with carbolised glycerine, he cut off the hooked portion, filled the cavity and canal, and replaced the tooth, which did well almost immediately.

He had seen the patient several times during the past eight years, and the tooth was still in good order. Perhaps

one of the most remarkable features of the case was that the osteo filling then put in was almost as perfect as the day it was done.

Mr. CUNNINGHAM observed that amputation of the end of a root in such cases as these was not altogether a new operation, and that he had seen numerous successful cases both in his own practice and in that of others, in most instances without even the very minute fistula alluded to in the case under discussion. Notwithstanding considerable experience he could not lay claim, as Mr. Woodhouse had done, to be able to distinguish by touch when he had reached the area where the tissues were quite normal. Indeed, he thought there was a good deal of haphazard in amputating the end of the root, and would give an illustration of a case. He remembered a troublesome chronic fistula from a lower molar, which had not yielded to the usual methods of treatment; he therefore determined to break up or remove through the alveolus the necrosed end of the root. Having by a probe traced the fistula to what he took to be the vicinity of the apex of the anterior root, he proceeded in heroic fashion to bur out the diseased part through the gum.

The treatment was only palliative, and after a time the abscess recurred in an acute form, when he finally resorted to the remaining alternative—extraction and replantation. On removal of the tooth he examined the roots (which were of extraordinary length) with a little curiosity, and found that instead of having amputated the end of the root, that he had excavated a part of the root about half way between the neck of the tooth and the apex. He cut away the diseased end of the root and promptly returned the tooth to its place with as little disturbance and medication as possible. In due course the tooth became firm, and so far there had been no return of the trouble. With regard to the necessity of amputating the root, he found much less need to resort to it since the introduction of the immediate method of root canal treatment. He had greater confidence in the operation of replantation than Mr. Wood-

house, and therefore, when amputation had failed, he had not hesitated to extract the tooth, remove the abscess sac, smooth the end of the root, and replant the tooth.

Mr. W. Hern had had one or two cases of a similar nature to that of Mr. Woodhouse. The first was one which he treated in private practice in October, 1887. The patient—a young lady—had two teeth (upper central incisors) pivoted, but unfortunately over each of the roots was a very large and chronic gumboil with rather a large papilla.

She said that the operator had taken off the crowns once, and tried redressing the roots, but without effect; he—Mr. Hern—then took off one of the crowns, found the root to all purposes healthy, and accordingly came to the conclusion that the mischief was due to necrosis of the root. The patient being young, and the teeth incisors, he did not like to accede to her request and extract them, but told her there was a *dernier ressort*. He applied some cocaine to one abscess sac, opened it and enlarged it by stuffing in some cotton wool; he could then feel that the end of the root was rough and naked. He then took a rough bur and burred off the end of the root; the wound was dressed with sulphate of copper, which seemed to hasten the healing process, and the case did perfectly well. After a short time there was nothing but a dimple in the gum, as described by Mr. Woodhouse.

He then undertook to treat the other incisor, which was likewise very satisfactory. But whether from contraction of cicatricial tissue or some other cause he could not say, at any rate a few years after the necks of the artificial teeth began to show in a dark line, and the patient wished him to put on two fresh teeth. In 1891 and 1892—four or five years afterwards—he cap-crowned both teeth, and they had remained perfectly firm and comfortable since. He was rather surprised that absorption of the roots had not taken place after such serious interference with the periosteum.

He had another case taken from hospital practice. A man, between 25 and 30 years of age, came to the London

Dental Hospital about eighteen months or two years ago with a large periosteal cyst over the right upper central incisor, following on the track of some old inflammatory trouble. When the patient was quite a youth at school, he ran against a pillar in the play-ground and broke off the right upper central incisor; then came a history of frequent abscesses, and finally a chronic swelling, which seemed to increase in size and gave distinct signs of fluctuation.

The cyst extended about an inch and a-half to two inches from the incisor to near the first molar; it was so large that it was not thought advisable to open it in the Dental Hospital, for fear of subsequent inflammation; the patient was therefore taken to the Middlesex Hospital, where Mr. Pearce Gould opened the cyst in the region of the canine fossa and evacuated a large amount of glairy fluid containing cholesterine. The patient stayed in the hospital one night, and left the next day doing very well. By passing a probe into the cyst Mr. Hern came down upon a piece of bare root; he made an incision over the root, cut off the apex, and picked it out of the cavity. The wound healed up completely. The cyst having been very large, the parts had not yet quite resumed their normal condition.

Mr. H. B. Gill wished to endorse Mr. Woodhouse's remarks as to the efficacy of iodine liniment. It was about fifteen years ago since he commenced to use it, and found it gave the greatest satisfaction in treating chronic alveolar abscess.

Mr. Woodhouse, replying, said he did not wish to claim originality for the operation; cases of a similar nature had been reported in dental journals, but he thought such a case would be useful in order to provoke discussion. Mr. Cunningham was rather sceptical with regard to his diagnosis as to whether the periosteum was healthy or not. He (Mr. Woodhouse) admitted there was a good deal of conjecture; he had to pass the drill down very deeply, and with firm pressure, to a point where he felt considerable resistance between the alveolus and the tooth, and therefore presumed, as he could not pass the drill further down, that he had got

to the part where the periosteum was adherent to the tooth; he then carried the drill to the opposite side of the tooth, where similar resistance was offered.

There was one other point he would like to allude to—the chance of fracture in extraction. He could not help thinking that in a great many cases there must be considerable risk in attempting to treat this condition by extraction and subsequent replantation.

The PRESIDENT thought that after hearing Mr. Woodhouse's case it would be an encouragement to those who had not tried the operation to do so as soon as they had the opportunity.

MR. REDMAN ON A CASE OF NON-ERUPTION OF TEETH.

He had seen a great many cases of non-eruption, but never one where so many teeth were missing. When first he saw the patient, a young lady about 23 or 24 years of age, the only teeth erupted were, in the upper jaw, two molars on each side, a misplaced canine and a central incisor very much decayed; whilst in the lower jaw were two molars on each side. The girl's parents were very much distressed about her appearance from lack of teeth.

The teeth erupted were of a very poor character indeed, all decayed, and almost hopeless. He gold-capped them all, putting a tube up the central incisor root as a support, and then inserted an artificial denture in the upper and lower. After the case had been worn some time, pressure, or some other cause, brought about the eruption of a lower incisor, but it came up very little, and after a year it still remained *in statu quo*. A bicuspid also erupted from the pressure, but was in such a miserable condition that he was obliged to extract it. The family history showed that the father and three daughters had all good and complete dentures, and the mother a very fair denture, but there was one bicuspid missing from her mouth at the age of 40; since taking the daughter's case in hand this bicuspid had erupted.

Mr. Robbins wished to ask Mr. Redman if the mental condition of the patient was up to the average, and whether the physical organisation was good, because in three cases that had come under his notice two of the subjects were not very bright, and the third case was where cousins had inter-married, and their offspring was not physically robust.

Mr. Redman said the girl was bright and intelligent, and, as far as he could judge, perfect in every respect with the exception of her teeth.

Mr. Storer Bennett, in answer to Mr. Robbins, would like to say that he had seen some cases of a somewhat similar nature to that of Mr. Redman's. He had in his mind one case in particular, where there was very marked absence of teeth in two sisters. When he saw them they were about 35 years of age, occupying very good positions in society, and were decidedly intelligent. It was not his experience to find that the mental condition in such cases was below the average. Some three or four years ago he had a case of a girl about 22 years of age with no lower incisors erupted; there were five teeth standing in the lower jaw and six in the upper jaw—four molars and two teeth in position of the centrals, but rather the shape of canines than centrals; these were very much decayed, and no others had appeared. She had two brothers and one sister younger than herself with fully developed dentures and very large teeth. He could not account for the girl having a deficient dentition. Her lower jaw retained the form of that of a young child.

Mr. Hern asked Mr. Redman if the temporary set was fairly normal, and also whether the patient was a younger member of the family; from cases under his observation it would seem to be more common in the earlier than the later members of a family.

Mr. Baldwin related a case of a young man aged 20, who in the lower jaw had only four molars and two incisors; he was the youngest member of the family, bright and intelligent, but rather delicate.

Mr. REDMAN, replying to Mr. Hern, said that the temporary teeth were perfect, and were shed at the proper time. The patient was the second daughter and not the eldest; the eldest daughter had perfect teeth, and likewise the two youngest daughters.

MR. WALTER COFFIN ON A SIMPLE AND EFFICIENT STRENGTHENER FOR LOWER VULCANITE DENTURES.

Mr. WALTER COFFIN described a simple and easily made strengthener for inserting in vulcanite, especially adapted for inferior dentures, partial or whole, which he had used extensively with great satisfaction for many years. It consisted of a metallic strip or wire of any section, preferably of oval or half-round hard platinum wire, and then wound or wrapped from end to end in an open spiral with a thin gold wire of about the size ordinary gold springs are made of, the whole soldered together with very small pieces or filings of gold solder. The platinum wire is first bent as accurately as possible to fit the model, then wrapped and soldered. It then becomes very rigid, but still slightly elastic in all directions. Any clasps, bands, or gold backings being used may be soldered to the strengthener. When not so held in place, a length of the thin wrapping wire may be left free at both ends of the strengthener and caught in the plaster when investing, to secure the exact position of it in the vulcanite. It is claimed for this form of strengthener that no line or plane of weakness is determined in the vulcanite; that there can be no longitudinal slip on bending; that the plate may be finished and polished right down to the gold without possibility of stripping or peeling in wear; that the strengthener occupies the whole thickness of the plate, showing slightly on both surfaces while affording a maximum of strength.

The PRESIDENT regretted not being able to call on Mr. G. Brunton for his casual communication, that gentleman being absent through illness.

Mr. J. Mansbridge on a Method of Mounting Calcified Microscopic Specimens.

The method of mounting which I am about to describe is one I have adopted for certain dry calcified sections where it is advisable to retain air in the structure for purposes of clear definition.

One great disadvantage in the use of a fluid balsam as a mounting medium for this class of sections, is the liability to run into any spaces, such as lacunæ or tubuli that may exist in the tissue, and thus render the specimen useless. To overcome this difficulty I have used with success, desiccated balsam in the following way:

Take a clean slide, place it upon a hot table with a small single lump of balsam upon it; use sufficient heat to slowly melt the balsam, which must not be made too hot. When sufficiently fluid lay the section upon it and cover with a hot cover glass, which must be pressed down in such a way as to expel all air from beneath it. Remove the slide to a cool surface and continue to keep pressure upon the cover glass for a few minutes, when the balsam will be found to be quite hard and the specimen ready to be labelled and put away finished.

The advantages of this method are I think (1) There is no chance of the mounting medium running in and spoiling the section, as it becomes perfectly hard a few minutes after removal from the hot table. (2) The specimen is finished at the time and is ready for the cabinet. There is no need to use a clip, and no fear of the cover glass shifting if the slide is placed upon its side. (3) It is very convenient for teaching purposes, as the ordinary stiff balsam in a bottle furnished with a glass rod, if used in a glass, soon becomes, together with the students, in a most deplorable condition.

Mr. Mummery thought the method described by Mr. Mansbridge would be very useful. In the Weil process, of course the desiccated balsam was used, with which the tissue becomes impregnated; it was not found that the

liquid balsam in which the sections were mounted ran into the tubes.

Mr. F. J. Bennett did not know if he quite followed Mr. Mummery. He (Mr. Mummery) appeared to like the desiccated balsam because it ran into the tubes, whereas Mr. Mansbridge liked it because it did not run into the tubes. He would like to suggest the use of glycerine jelly, which might be used of such consistence that it could not run into the tubes, and at the same time it excluded the air.

Mr. D. P. Gabell suggested Mr. Charters White's method of impregnating the section with collodion and mounting in Canada balsam.

Mr. Mansbridge, in answer to Mr. Bennett, thought that a section mounted in glycerine jelly hardly so permanent as one mounted in desiccated balsam.

Mr. Humby on the Annealing of Gold Foil.

Mr. Humby said: At the last meeting of this Society Mr. Brunton of Leeds brought forward a spirit lamp for low temperatures designed for avoiding the reddening of gold during annealing, the reddening being considered by him detrimental to the working qualities of the gold. In conversation with him after the meeting I informed him of some experiments I had made some years ago on the subject, and was induced by him to promise a casual communication for this evening. As it was so long ago I had almost forgotten the details of my results, and have spent the whole of to-day in going through a series of experiments, the range of heat beginning at about the melting point of tin, and ending when the melting point of gold was reached.

I had previously found that at 440° F., or thereabouts, the cohesive property developed, and that deterioration seemed not to be caused by any particular temperature

alone, but was the result of keeping the gold for a certain time at such heat.

My first test was at, or slightly above, the melting point of tin.

At 1 second softness and cohesion were obtained.
,, 5 minutes ,, ,, ,, ,, ,,
,, 10 ,, ,, ,, ,, ,, ,,
,, 15 ,, ,, ,, ,, ,, ,,
,, 20 ,, ,, ,, ,, ,, ,,
,, 25 ,, ,, ,, ,, ,, ,,

At the melting point of lead or slightly above it :—

At 1 second softness and cohesion were obtained.
,, 5 minutes ,, ,, ,, ,, ,,
,, 10 ,, ,, ,, ,, ,, ,,
,, 15 ,, slightly reduced softness and reduction of cohesion.
,, 20 ,, still more loss.
,, 25 ,, ,, ,, ,,
,, 30 ,, ,, ,, ,,
,, 35 ,, ,, ,, ,,
,, 40 ,, ,, ,, ,,
,, 45 ,, greatest hardening and loss of cohesion.
,, 50 ,, less ,, ,, ,, ,, ,,
,, 55 ,, ,, ,, ,, ,, ,, ,,
,, 60 ,, ,, ,, ,, ,, ,, ,,
,, 65 ,, gold returned to a good working condition.

At zinc melting point or slightly above :—

At 2 minutes slight loss of cohesion and softness.
,, 5 ,, return of ,, ,, ,,
,, 10 ,, ,, ,, ,, ,, ,,
,, 15 ,, ,, ,, ,, ,, ,,
,, 20 ,, ,, ,, ,, ,, ,,
,, 25 ,, complete restoration of softness and cohesion.

At a dull red heat ascertained by darkening the room, at every test up to twenty-five minutes, at five minute intervals, the gold remained exceedingly cohesive and soft.

The next test was a bright red on platinum foil. These

tests were continued until the platinum adhered to the gold. There was no deterioration whatever.

The next tests were with the flame in contact with the gold and were from a dull red upwards until the last cylinder melted to two-thirds of its original length, and this most highly heated cylinder was softest and most highly cohesive of any of the series tried. The gold employed was Messrs. Smale's No. 1 A cylinders.

Mr. W. COFFIN was inclined to confirm Mr. Humby's conclusions as to the absolute molecular softness of gold; but when a cylinder, formed of a number of laminæ, was treated so as to transform it into a bar, its properties as a filling material were essentially changed.

Mr. BALDWIN thought gentlemen must have found that if gold cylinders were at all sweated they absolutely refused to stick. For a long time he had been working with one thickness of No. 20 gold, and found it made no difference whether this was sweated or not.

Mr. GILL remarked that some years ago he was informed by a jeweller that if gold plates were to fit well they must be annealed in charcoal. He began making experiments, and found just as Mr. Humby described, that when first the plate was put in the heat it hardened, but by prolonged annealing it became soft. He found also that charcoal dirtied the gold and caused deterioration of quality.

MR. ASHLEY BARRETT ON SOME ABNORMAL TEETH.

The first case was that of a tooth which represented a lower incisor in the mouth of a girl, aged 15 years, with a peculiar cusp on the lingual surface. The second case was a right upper first and second molar fused together, which were removed from a female aged 40. There was a history of chronic irritation and offensive odour. He was anxious to remove the first molar, but the second also came away, the two being joined by cemental union.

Mr. Robbins, for Mr. Gould, of Madras, showed two models of a patient, aged 22, exhibiting in a very marked manner the condition known as "open bite." Mr. Gould desired the opinion of members as to the best means of treating the case.

A vote of thanks having been accorded to those gentlemen who had brought forward casual communications, the meeting adjourned until May 1st.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

May 1*st*, 1893.

Mr. R. H. WOODHOUSE, M.R.C.S., L.D.S.

Vice-President, in the Chair.

The Minutes of the previous meeting were read and confirmed.

Sutcliffe, Charles Frederick, L.D.S.I., 15, Victoria Terrace, South Shields, was nominated for Non-resident Membership.

The following were balloted for and unanimously elected Non-resident Members:—

Durwood, P. Stewart, L.D.S.Edin., 127, Mayfield Road, Edinburgh.

Fraser, James Leslie, L.D.S.Edin., 5, Castle Street, Inverness.

Shiach, Gordon Reid, L.D.S.Edin., 1, North Guildry Street, Elgin.

Smith, Arthur Hopewell, L.R.C.P.Lond., M.R.C.S Eng., L.D.S.Eng., Lindum House, Boston, Lincolnshire.

Stewart, James, L.D.S.Edin., 19, Princes Street, Perth.

The Librarian reported that in addition to the usual Journals and Transactions of Societies, he had received *The Transactions of the American Dental Association*, 1892, and "The Testimony of the Teeth to Man's Place in Nature" by F. H. Balkwill, presented by the author.

The Curator (Mr. Storer Bennett) said he had the pleasure to announce a very valuable donation to the Museum, from one of the corresponding members—Mr.

Kölliker, of Zurich. It consisted of an extremely well-arranged case of instruments, comprising amalgam carriers, matrices and matrix holders, very thin files and file-carriers, and some new forms of thin flexible metal powder carriers for polishing contour fillings, these instruments being used on the burring engine. As would be seen, they were cup-shaped and flexible, so that they would readily accommodate their shape to the form of the particular filling by a little pressure being exerted on them during rotation. Mr. Kölliker claimed for the matrices that a plastic filling, having the normal contour of the tooth, could be more readily inserted with these instruments than with any others.

Mr. Bennett also presented to the Museum the lower model of a woman about 23 years of age, a patient at the Dental Hospital. It was noticed that she had a small conical supernumerary tooth on each side of the mouth in the situation normally occupied by the first molar. On the left side the supernumerary tooth was immediately in front of the second molar, and on the right side it was directly behind the second bicuspid. The teeth were extracted, and could be seen in the model.

Mr. Bennett also stated that while recently on a holiday in Holland with his brother, they had visited the Zoological Gardens at Amsterdam, where they had been much interested in seeing—in the anatomical museum—the lower jaw of a female deer (*Cervus equinus*) with a large odontome on each side in the position of the third molar.

They had also noticed the skull of a female orang-outang (*Simia satyrus*), in which the second upper pre-molar on the right side had erupted outside the malar portion of the zygoma, and above the first permanent molar, but quite half an inch external to it. The tooth was directed obliquely downwards and outwards, the crown only being erupted, but a completely formed alveolar socket had been formed around the root. The tooth on the left side was normal in position, but not in articulation. The antagonism of the teeth was remarkably deranged, the upper canines biting on the posterior aspects of the first

lower pre-molars, instead of between their anterior aspects and the lower canines. The first and second right upper molars bit on three-fourths of the first and second lower molars, while on the left side the second pre-molar bit wholly on the first lower molar; the first upper molar bit only on the posterior fourth of the first lower one, and the second upper molar on the posterior third of the second lower molar.

Mr. Storer Bennett's specimen of orang's skull, showing pre-molar erupting outside the arch.

It was very remarkable that the antagonism of such important teeth as the canines should be so modified as to remove the upper ones entirely from contact with the lower, causing them to bite only between the cusps of the lower pre-molars.

These specimens were considered so interesting that an endeavour was made to effect their purchase, but ineffectually. Every facility was, however, afforded for examining the specimens, and permission to take casts readily accorded. A wax model of the right half of the orang's skull was therefore taken, showing the misplaced upper pre-molar, and the plaster cast obtained from it Mr. Bennett had great pleasure in presenting to the Museum.

The Chairman announced that Mr. Watson having been unable to be present when his paper on "The Pathological Conditions of the Pulp" was discussed, had sent the following reply, which was read by the Secretary:—

"Mr. Bennett said that he took exception to the remark

that the formation of dentine of repair after abrasion and erosion was a sign of the beginning of the end. I meant this to apply more particularly to those nodules in the pulp tissue, by the aggregation and coalescence of which the pulp is gradually destroyed, leaving the tooth in a condition more susceptible to disease. As regards Mr. Mummery's remarks, I may say that I did not stain for micro-organisms; all the preparations were stained with picro- or borax carmine. Mr. H. Smith said that he was rather puzzled about micro-organisms in connection with hypertrophy of the pulp. This pathological condition was caused, probably, not by organisms directly, but by the irritation of their products. Mr. Baldwin asks if it is possible by antiseptic dressing to get a carious cavity and exposed pulp into a thoroughly healthy condition. This all depends on the amount of destruction of the pulp, the length of time which it has been exposed, and the condition of health of the individual. Recent exposures might be treated successfully, and the tissues brought into a healthy and aseptic state, but if the pulp has been exposed for some time it is far better treatment to destroy. Mr. Ashley Barrett asks as to the precise cause of staining of teeth. This I attribute to the blood in acute pulpitis being forced into the tubules and depositing the colouring matter. Mr. S. Spokes wished to know as to the process of calcification of the exudates. I suppose he means the formation of calcareous granules from the exudates. All that is wanted for the formation of such concretions is the presence of albumen and lime salts. As regards the process of calcification, my slides ought to have shown that the process of calcification invades all the tissues of the pulp, masses forming both round vessels and nerves. The presence of pulp stones indicates that the pulp is in process of calcification."

The Chairman called attention to the Medical Congress which was to be held in Rome this year, and reminded the members that a form of application for membership could be obtained from the Secretaries by any who wished to attend.

Mr. J. H. McCall presented models showing (1) Trans-

position of Bicuspid; (2) Exaggerated Cingula on Upper Incisors; (3) Home-made Specimens of Mechanical Dentistry.

The first model was that of the upper jaw of a young lady, aged 21. Both the lateral incisors had been extracted, and on the right side the first bicuspid occupied the place of the missing lateral. The bicuspid was twisted, so that its mesial side was presented to the lip. Mr. McCall elicited from the patient that the laterals had been extracted soon after their eruption to relieve crowding. He considered the result of the treatment very unsatisfactory, as the disfigurement to the patient was considerable.

The second model was taken from a boy aged 15, and showed upper lateral incisors having well-marked cusps on their lingual surfaces.

The third models were taken from the mouth of a middle-aged woman, and showed the patient's ingenuity in providing herself with artificial substitutes after losing her molars and bicuspids. Her *modus operandi* was first to soften a few strips of brown gutta percha in hot water, kneading them into blocks of a convenient size and shape. Having made four of these blocks, she pressed them rapidly into place, and by closing the jaws while the gutta percha was still soft, she obtained a very good "bite." Portions of broken-down teeth and ragged stumps served as retaining posts for the gutta percha blocks, and the patient could use them freely in mastication without any fear of displacement. The models presented showed these blocks *in situ*.

Mr. CUNNINGHAM referred to a case of "home made" dentistry in which the material used was not gutta percha but wood. It was that of a porter at Chatteris, on the Great Eastern, who had lost all the upper teeth, and was wearing a very primitive denture in the lower jaw. On investigation, he found that the man was in the habit of making his own lower denture. The front incisors had gone, owing to the accumulation of tartar, such as might

be expected in the case of an old man who had not any particular hygienic habits with regard to his mouth. He had not the faintest notion how the man got the idea, but the denture was very much like the bone work that one used to see. His first denture was made by whittling out a piece of wood, which fitted across between the two incisors, but after wearing that for some time he arrived at a position in which something more was wanted. In exchange for his wooden plate he (Mr. Cunningham) made him a denture fit to wear, and he still received tributes of thanks at intervals from this railway porter. The man said he should have lost his situation if it had not been for his being able to make this denture, because otherwise he would not have been able to pronounce the name of the station.

Mr. Coxon, with reference to the case of which Mr. Cunningham had spoken, said that he had the veritable denture in his possession, but had unfortunately mislaid it, or he should have shown it. It was very ingeniously made, inasmuch as where the man had the stump of a bicuspid standing up, he had drilled out the piece so as to leave that stump entirely free, and at the same time let the denture rest on the gum. It had to be frequently renewed. In one case it was made of larch; all the rest were made of oak.

Mr. Robbins mentioned a case which came under his notice quite recently, as showing how a patient was sometimes able to repair a piece, or to make it presentable. It was that of a woman who was living a long way from dental help. A canine had broken away from its backing, and, as she had to make a number of calls in the district where she resided, she tried to remedy the defect; after several unsuccessful attempts she got a very good match and a very good result by carving a piece of turnip. If it was not the shade she wanted she had some method of staining it. When he saw the case it was neatly tied to the gold backing, and at a little distance it could scarcely be detected from a natural tooth. Of course it did not last long, and she had to make a fresh one every day.

Mr. Ackery said that cases of this sort were not as rare as some might imagine. Some three or four weeks ago, at St. Bartholomew's Hospital, a patient asked him to remove two lower stumps, not because they pained him, but because he was going to have some artificial teeth. It was suggested that he should see the gentleman who was going to make the teeth before the stumps were removed, but the reply was that he was going to make his own. On being asked how he was going to set about it, he said he had taken the cast of his mouth, reproduced it in plaster, and from that he had made a mould, in sand, and had made a die of iron. He proposed to use silver for the plate, and he asked where he could get the artificial teeth. He (Mr. Ackery), took rather an interest in the man, and suggested that if he brought the work as far as he had got on with it, he would try and help him in its further progress. The man had not yet turned up, but there might still be an opportunity of seeing the silver plate and of helping him to some method of attaching the teeth.

A Description of Dr. Röse's Models of the Development of the Teeth, by Mr. J. Howard Mummery.

It may be remembered that in my address in January last, I drew attention to some investigations of Dr. Carl Röse, of Freiburg, in Baden, on the development of the teeth of man, and that I then said that copies of the models prepared by him were on their way to England, and that I hoped soon to be able to present them to our Museum.

The copies are made by Dr. Ziegler, preparer of anatomical models in Freiburg, and as none were ready when my order came, they had to be specially prepared, and did not arrive in time for the meeting in January.

I thought that it might be interesting to the members of the Society to have a short explanation of these models, which are now upon the table, as they require some little preliminary study to render clear the points they are intended to elucidate. I have also photographed them, and prepared a small set of lantern slides, which I have

coloured similarly to the models, to render the explanation a little clearer to the meeting.

The special point about them is that they are modelled from microscopical sections by a method known as Born's method of modelling, and used a good deal on the Continent in the study of embryos. There are many modifications of this method, and I do not know what particular process was used by Dr. Röse, but the results may be obtained in the following way :—

Serial sections of the object to be investigated are cut with an automatic microtome, such as the "Cambridge rocker," until the whole of the object to be modelled has been cut up. These sections are then separately photographed, every section so photographed being magnified to the same extent. We have then a series of photographs of the whole thickness of the object, arranged in serial order. Sheets of wax are now taken, the thickness of each sheet bearing a certain definite relation to the magnification of the section : that is to say, if the sections are magnified 50 times, the wax plates must be 50 times thicker than the sections, so that the resulting model shall correspond in size with the original object in all its dimensions. By means of transfer paper the outline of the photograph is transferred to the wax, and the wax carefully cut out along these outlines with a knife.

The pieces of wax so cut out are placed one upon another in their proper order, and their edges united by the help of a warm spatula. We thus have a model in wax of the original object, which will be magnified to the same extent in every direction as the section was magnified in the photograph.

In practice it is not found necessary to take every section of the series in constructing the model, as this would make it an unduly long and tedious process ; but very accurate models can be made by using every third, or every fifth section of the series, a corresponding calculation being of course made for the proportional thickness of the wax plate.

In his printed description of the models before us, Dr.

Röse says: "In the present models, the 'zahnleiste' [tooth-band or epithelial lamina of Magitot], and the tooth rudiments were strictly copied from the original section models, whilst for the explanation of the relations of the parts of the jaw and mouth, Models 3 and 4 were modelled from nature."

In order rightly to understand these models we must remember that the epithelial structures, and these alone, are represented, which makes them somewhat puzzling on a first inspection. The portions of the tissue belonging to the mesoderm, such as the dentine papilla, are not represented, but only shown as a hollow space.

The colouring of the different parts is as follows:

Orange.—Epithelium of the mouth, of the jaw, and of the lip.

Green.—The "zahnleiste" or "epithelial lamina."

White.—The epithelium of the outer surface of the tooth sac * (outer epithelium of the enamel organ).

Dark Red.—The inner epithelium of the enamel organ.

Rose.—The enamel pulp—gelatinous tissue of the enamel organ (stellate reticulum).

Yellow.—The calcified enamel.

Blue.—The calcified dentine.

In describing the models with the help of the lantern slides I propose to make use of a translation of the descriptive paper accompanying the models, and of Dr. Röse's original paper, "Ueber die Entwickelung der Zähne des Menschen," published in the *Archives für Mikroskopische Anatomie* for 1891, Band xxxviii.

Before describing the models it may be well to mention the different views held as to the mode of development of the teeth germs from the original epithelial band. Three principal views have been held:—

(1) That stated in Tomes' "Dental Anatomy," and, I believe, generally taught in England: that the permanent teeth proceed by growth from the neck of the enamel organ of the milk teeth.

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* Enamel germ.

(2) Baume's view: that the permanent tooth germs develop from the remains of the primitive inflection, without any connection with the temporary tooth germs.

(3) The view held by Dr. Röse that both temporary and permanent teeth take their origin from a common "tooth-band," which he calls the "zahnleiste."

This original epithelial band he describes as being divided in an early stage into two portions—one, which is the flatter portion of the band, passing almost perpendicularly into the lip and jaw, and connected with the formation of the lip furrow (which he calls the "lip furrow band"), and another part which passes almost horizontally backwards to form the real tooth-band (Röse's zahnleiste).

According to this view, which we have to consider in connection with the models — there is an uninterrupted layer of epithelium passing all round each jaw as a continuous horizontal sheet.

The papillæ of the teeth do not push themselves at right angles into the deepest portion of this epithelial band, but sideways, so that in the upper jaw they advance from above and behind, downwards and forwards; and in the under jaw from below and behind, upwards and forwards. Thus a free growing margin of the epithelial lamina is found behind the papillæ of the temporary teeth, and can go on growing after the milk teeth have become constricted off from it. From this grown-back portion of the original epithelial lamina the permanent teeth are formed—so that we cannot correctly say that the permanent tooth is formed from any neck of the enamel organ of the temporary tooth.

Model I. x 25.

"Mouth of a fœtus of 2.5 cms. long. The opening of the mouth of the embryo is here represented with a part [of the epithelium] of the lip, and [of] the mucous membrane of the mouth. In both jaws the tooth-band (coloured green in the models) runs as a curved band directed backwards.

"In the under jaw this band already shows an undulating

margin, and partial enlargement. The lip furrow band is, like the remaining epithelium of the mouth, coloured orange."

Dr. Röse says: "The first trace of the tooth-band is formed simultaneously in both jaws at the embryonic age of 34 to 40 days. At 48 days the simple band has split into two separate bands, lying rectangularly one to the other; the lower one running perpendicularly into the jaws is the 'lip-furrow band,' the other, passing horizontally backwards, is the true tooth-band."

Model II. x 25.

"This model exhibits on the same scale a similar view in a fœtus 4 cms. long. The tooth-band is now modified. Its free edge is, at more or less regular intervals, thickened to a club form, and in these situations has grown around the connective tissue cone (papilla or pulp) in a bell shape. (Earlier authors described this process as a turning up of the papillæ into the epithelial band.)

"In each jaw are seen the germs of the ten milk teeth. The portions of the tooth-band lying between them are already beginning to grow out irregularly. The free edge of the tooth-band shows a wavy margin."

Model III. x 25.

"Shows the upper jaw of a fœtus of $11\frac{1}{2}$ cms. long (14 weeks old).

"In the original section model the tooth-band, with the neighbouring epithelium of the jaw, only was shown, while in this model the gums, lip, lip furrow, and lip-furrow band were modelled from another fœtus of similar age. The tooth-band does not pass strictly in a horizontal direction backwards, but in a slight curve; backwards and upwards in the upper jaw—backwards and downwards in the lower, into the mesoderm of the jaw.

"The irregular growth and budding already visible in the previous model are here seen to have increased. The free edge still forms a wavy line. On the summits of the waves

are placed the tooth germs in front of, and above the tooth-band, looking like swallows' nests attached to a narrow beam. The pulp cavities of the teeth have deepened, and in the milk molars one sees slight indications of sub-divisions.

"Throughout the whole the tooth germs show a tendency to detach themselves from the tooth-band, and this constricting process has proceeded furthest in the region of the incisor teeth.

"Behind the second milk-molar the tooth-band has grown further backward on each side, and ends in a thin epithelial plate.

"The connection of the tooth-band with the epithelium of the jaw is already partially cut off by an absorption process. The line of demarcation is visible on the surface of the epithelium of the jaw as a shallow furrow (tooth furrow). This runs in the model before us still chiefly on the outer side of the wall of the jaw, but in the region of the incisors on the top of the jaw wall."

Model IV. x 25.

"This shows the left half of the under jaw of a fœtus of 18 cms. long (17 weeks old).

"Through the growth of the milk teeth, the configuration of the jaw is altered in such a way that the tooth furrow passes partially on the summit, partially on the posterior surface of the wall of the jaw.

"This tooth furrow (which, as mentioned, indicates the demarcation line of the tooth-band from the epithelium of the jaw) is in some places fairly deep, in others scarcely indicated, in places even obviously double, according to the more or less irregular disposition of the tooth-band. The tooth-band already shows an early stage of absorption in the form of commencing perforations.

"The germs of the milk teeth are attached to the tooth-band only by means of the more or less broad connecting bridges, and are otherwise entirely detached. Behind them, the tooth-band has grown further as free plates, now

PLATES ILLUSTRATING MR. H. MUMMERY'S COMMUNICATION.

FIG. 1.—MODEL OF THE UPPER JAW OF A FŒTUS 9 WEEKS OLD.

a, The tooth-band or epithelial lamina.
b, The lip furrow band.
c, The lip furrow.
m, The opening of the mouth.

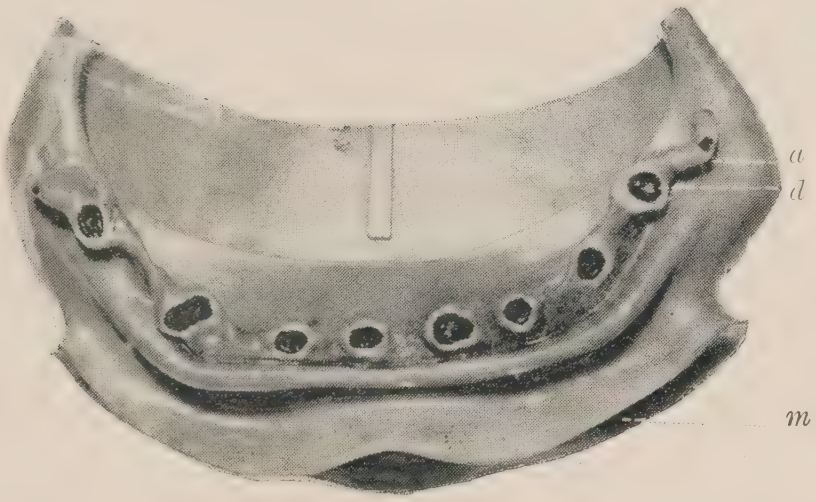

FIG. 2.—MODEL OF THE UNDER JAW OF A FŒTUS 11½ WEEKS OLD.

a, The tooth-band or epithelial lamina.
d, The tooth germs.
m, The opening of the mouth.

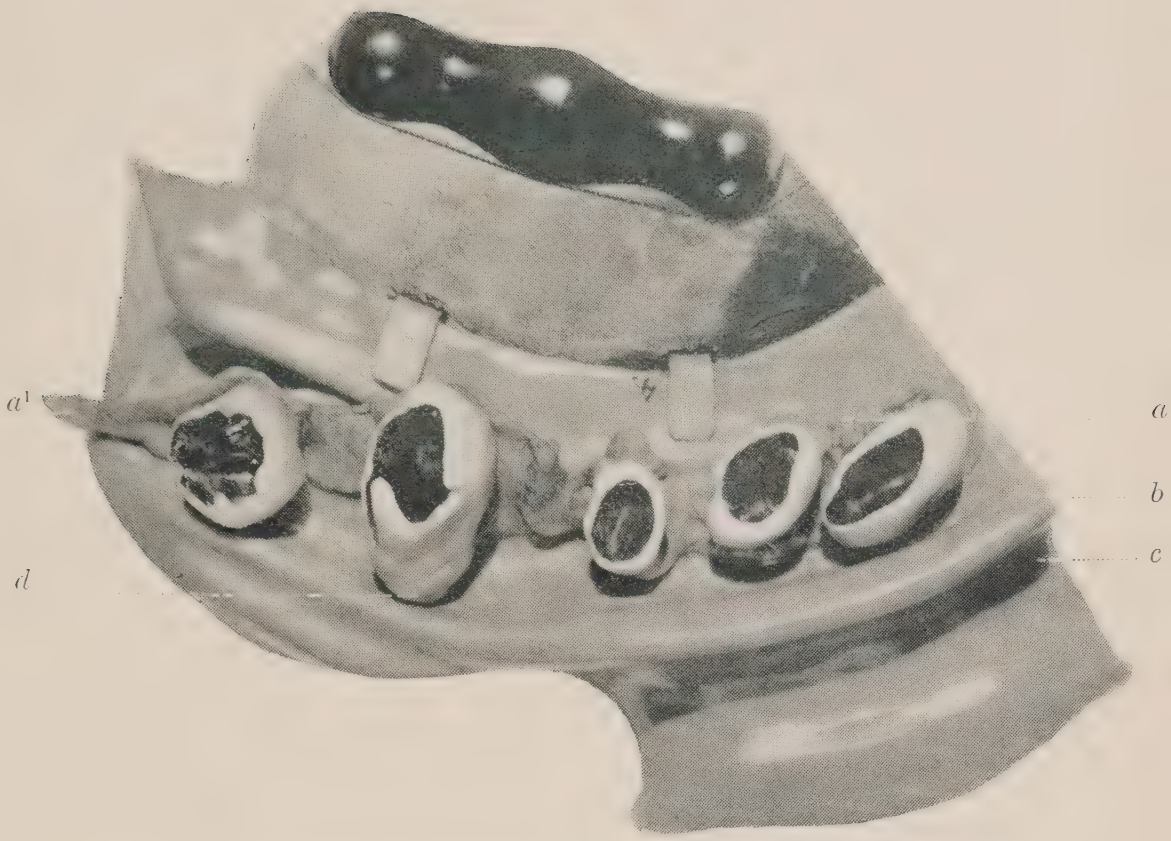

FIG. 4.—LEFT HALF OF THE LOWER JAW OF A FŒTUS 17 WEEKS OLD.

a, The tooth-band or epithelial lamina.

a^1, The continuation of the tooth-band beyond the germ of the second milk molar, and indicating the point at which the germ of the first permanent molar is appearing.

b, The lip furrow band.

c, The lip furrow.

d, The tooth germs.

more or less standing by themselves. The sub-divisions of the pulp cavities in the milk molars are very clear. The end of the tooth-band (behind milk molar 2) has thickened, and also grown around the papilla of the first permanent molar."

Model V. x 40.

"Shows the two incisor teeth of the right side of the under jaw of a fœtus of 30 cms. long (24 weeks old), in connection with the tooth-band, and a portion of the epithelium of the jaw, so far as it includes the tooth furrow.

"To understand the model exactly, one must grasp the fact that the tooth furrow in this stage is turned to the hinder surface of the jaw. A larger portion of the central than of the lateral incisor is represented. The teeth are already quite advanced in development, and have permanent tooth substance, both dentine and enamel (coloured blue and yellow in the model).

"The outer epithelium of the enamel organ (white) shows perforations in places, through which the enamel pulp (rose coloured) appears. The reticulum lying between them is correspondingly thickened. The tooth-band is perforated like a sieve, and shows excrescences and out-growths.

"In two distinct places behind and at the side of the milk tooth germs the "band" is not perforated, but on the contrary, swollen in a knoblike fashion; and in these places the paillæ of the permanent incisors have grown up. (The epithelium of this papilla is stained dark red in the model.)

"The papillæ of the permanent teeth lie (like those of the milk teeth) to the side of the tooth-band and in a direction towards the milk tooth. They are brought into view by observing the model from below. The germ of a possible third dentition repeated in a similar manner is therefore *a priori* quite imaginable."

Model VI. x 15.

"This shows the second milk molar (the larger part), and the first permanent molar (a smaller portion), of the left

under jaw of a fœtus in connection with the tooth-band, and a portion of the epithelium of the angle of the jaw. The tooth-band (which already in the previous stage was perforated in a sieve-like manner in the incisor region), shows now, at the time of birth, in its hindermost portion a solid plate, but which still in places is attached to the epithelium of the mouth.

"Behind the angle of the jaw the tooth-band proceeds as a narrowing plate free into the mesoderm of the jaw, and ends over the first permanent molar, which is embedded deeply in the bone of the angle of the jaw. With the enamel organ of this first permanent molar the "tooth-band" is still attached by means of a short but broad connecting bridge.

"The connecting bridge shown between the tooth-band and the second milk molar is perforated in places. The outer epithelium of the enamel organ of both tooth germs is perforated in places, so that the enamel pulp shows through (on the model) in rose-coloured spots.

"In the stage before us the germs of the (permanent) premolars (bicuspids) are not yet visible. There is also no germ to be perceived of the second permanent molar. Immediately after birth the end of the tooth-band grows beyond the first permanent molar, to give origin to the succeeding molars. The (permanent) premolars (bicuspids) become developed towards the end of the first year."

There is an interesting point noticed by Dr. Röse (in his paper above referred to) in connection with the perforation and breaking up of this tooth-band or epithelial lamina and its gradual absorption. It can be easily seen by these models how remnants of the epithelial lamina may persist, and give rise to such irregularities as supernumerary teeth, odontomes, &c., other portions becoming degenerated and not absorbed, giving origin to such abnormal structures as cysts and epithelial pearls.

The Chairman said Mr. Mummery's modesty only allowed him to call this a casual communication, but looking at the valuable matter it contained, and the excellent way in which it had been brought forward, it might be well regarded as the paper of the evening.

Mr. Storer Bennett referred to the difficulty, in those extremely interesting, though rare cases, in which they had a history of no temporary teeth being erupted at all, the permanent teeth coming through the jaws at the normal period, of understanding—taking the accepted view of the development of permanent teeth—how those permanent teeth could have been developed from the necks of temporary teeth if there had been no temporary teeth developed previously. But if they accepted this view, that a common tooth-band gave off first the temporary set and then the permanent set, it was quite easy to understand that for some reason or another the temporary set could of course have never been developed and erupted. The germs were already provided for the permanent teeth, and therefore it was quite easy to understand that they might get a permanent tooth without a temporary tooth. Such cases were on record, and had always been exceedingly difficult to explain and understand, but if this view of the development of teeth was correct, it helped one to understand the cause. It also threw light on the development of the permanent molars from behind the temporary, which was always rather difficult to understand as generally described.

Mr. F. J. Bennett on the Resemblance of some Forms of Inflammation in Bone and Teeth.

Some interesting cases have been recorded at the Pathological Society, by Mr. Watson Cheyne and others, of a condition first described by Sir James Paget under the name of "quiet necrosis," which illustrate on the one hand the intolerance of dead tissue by the living body, and on the other hand the extent to which large masses of dead tissue can be removed without obvious symptoms of inflammation. It appears in these cases that large sequestra have been found, surrounded by masses of granulation tissue, occupying the medullary cavities of long bones, and this condition is supposed to be brought about by previous attacks of periostitis, which have caused such pressure on the nutrient artery supplying the interior of the bone as to have resulted

in the death of that portion. Being entirely removed from septic contamination, no suppuration followed—hence the term "quiet necrosis."

I mention these cases because it is admitted they illustrate that mere devitalised tissue is subject to absorption, even though free from septic irritation, and because it has been assumed by some dental practitioners that it is only necessary to disinfect the root canals of dead teeth, and not to fill them also.

The specimen of absorption which I have brought down for exhibition this evening shows very well the result of such treatment, though I do not pretend that even disinfection has been completely performed.

The tooth from which the section was made had been filled in the crown and pulp cavity, but not in the fangs, and the canals of these fangs are seen to be in every part attacked by absorption. The method by which this is brought about is entirely similar to that described by Mr. Watson Cheyne as occurring in the interior of long bones, namely, by the development of highly vascular granulation tissue, which brings the absorption cells, or osteoclasts, into contact with the dead tissue, which they quietly remove.

Mr. Hepburn on a Case of Superior Protrusion.

Mr. David Hepburn exhibited models of a case of non-inherited superior protrusion, and illustrated the progress of the case in its various stages by a series of ten lantern slides. The case was a very pronounced one in a young lady of 14 years, an age which Mr. Hepburn considered favourable for the correction of the deformity in this particular instance. The apparatus employed was shown and explained. It consisted of a vulcanite plate capping the first molar and second bicuspid teeth (the first bicuspids having been removed), with an arrangement of gold wire springs acting on each tooth individually. This Mr. Hepburn considered a more effective and more easily managed method than that of employing a continuous band designed to act on all the teeth collectively. He deprecated too

forcible or too rapid treatment, maintaining that more lasting results were obtainable by the slow method, and that probably less elongation of the teeth would result.

Mr. Hepburn also related a case of spontaneous cure of protrusion.

Mr. Baldwin wished to ask whether the interference with the bite, mentioned by Mr. Hepburn, was usual. In his experience good results had invariably followed when all the back teeth had been capped.

Mr. Mummery, in reference to the last-mentioned case of spontaneous cure, asked whether, seeing the way in which the lower incisors struck the backs of the upper incisors, when any more molars were lost the teeth would not come forward again.

Mr. F. J. Bennett remarked that the reason why a self cure could not be expected in the first case was that the bite was altogether too forward. The second upper bicuspid, instead of biting between the first lower molar and the second bicuspid, bit in between the two bicuspids, and so with the molars. He noticed by the models that soon after the first bicuspid had been extracted, the second bicuspid had gone forward, and was occupying the space between the first and second bicuspid. The protrusion was really owing to pressure from the back of the mouth, and was not therefore likely to have cured itself. In the second case shown, the bite of the back teeth was normal, or nearly so, and that accounted for the self cure.

The Chairman asked what means Mr. Hepburn proposed to adopt to keep the teeth in position, because they would be likely to very soon come out again without a retaining plate.

Mr. Lawrence Read was sorry that Mr. Hepburn had fallen out with pianoforte wire, because for the inside of the mouth nothing had ever been used that was so comfortable and less conducive to raising the bite or displacing it in any way. His own experience of stout gold wire showed that

it disarranged the bite, but he had found by using the steel wires, and gradually increasing the pressure, he could move teeth further, with less pain, more effectively and with less interference with the bite. It required careful adjustment. The majority of people who used steel springs made them too stout and not sufficiently long. A long spring was more durable, much easier for the patient, and altogether more effectual. He was sorry that Mr. Hepburn (whose opinions had great weight at the Hospital School), should put forward gold wire as superior in every respect to steel.

Mr. Badcock asked if the plate shown was used as a retaining plate; and if so, whether the capping of the bicuspids did not account for the mal-occlusion.

The Chairman, having called upon the authors to reply,

Mr. Mummery said the only remark he would make was to say that he wished to present the models to the Museum.

Mr. Hepburn had very little to add. With regard to Mr. Baldwin's question, he meant that in that particular case the interference with the bite was inevitable. He could not see in that particular case how the teeth could be moved into their present position without upsetting the bite. The second molar was not capped; the first molar and bicuspids were capped, but if they had been left to themselves and the other teeth brought in by any means, he thought there would have been interference. It was quite inevitable, Mr. Mummery had said, that in the second case, if the molars were lost, irregularity would re-assert itself. He (Mr. Hepburn) was fully convinced it would; and although the teeth were still retained, they were simply a mass of patchings and stoppings in order to retain them as long as possible, because the moment the back teeth were lost the incisors would come out again. With regard to the point of a retaining plate, he had used the plate exhibited for that purpose as long as he could. The teeth had been left to themselves for about a fortnight,

but they did not show any tendency to come out again. He knew Mr. Read was a great admirer of pianoforte wire, and so was he, especially for hospital work, where they could not indulge in gold springs to any extent. In his private practice, however, he had settled down to the use of gold wires. Very often the piano wire seemed to give way; but he never found that the case with gold wires if properly made and adjusted.

A vote of thanks was then accorded to the authors of the communications.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

June 5th, 1893.

Mr. W. B. MACLEOD, L.D.S.Edin.,
President, in the Chair.

The Minutes of the previous meeting were read and confirmed.

Messrs. T. Herbert Clarence and A. Curling Hope signed the obligation book, and were formally admitted to membership by the President.

The President announced that he had received obligation forms, duly signed, from the following gentlemen:—Messrs. James Stewart Durward; Arthur Hopewell Smith; James Stewart.

The Librarian reported the receipt of "The Official Year-Book of Learned Societies, 1893," and "The Hawks and Owls of the United States in their Relation to Agriculture," from the United States Department of Agriculture.

(*a*) A Case of Replantation. (*b*) A Case of Cemental Union. By The President.

Cases of replantation are neither new nor unsuccessful. As to the antiquity of the operation we can go as far back as the literature of surgery can carry us, and as to its

success, this has been established in the authentic record of numerous cases from the earliest period of the practice of our speciality as an independent branch of surgery. Yet though thus old, every succeeding case is worthy of being placed on record, as, apart from special circumstances which may make it individually interesting, it keeps before the mind of the busy or the young practitioner the possibility and propriety of restoring an avulsed tooth to its socket.

The models which accompany this communication are of the upper and under teeth of a strong and healthy youth $13\frac{1}{2}$ years of age. I took the impressions for the purpose of securing the model of a slight abnormality ; that in the under denture being the most interesting. On the left side there are four well-formed and massive molars, two of these being the temporary molars, and the other two being respectively the first and second permanent six and twelve-year-old molars. To a hasty observer or to a general scientist aware that there should be only three molars in the human adult, the appearance that this side presents might lead to the conclusion that the individual was the happy possessor of one more grinder than his less fortunate brethren, or if seen in the mouth of a savage might give rise to the statement that this particular tribe still retained the molar which was missing in the mouths of the more civilised peoples, a statement which has been made more than once, but which this and other instances of a like nature justify us in setting down to hasty and inefficient examination. The upper model had nothing more extraordinary to show than the retention of both temporary canines in a well-formed and uncrowded arch, and I took the impression of it more as a companion to the under, and to possess a complete reproduction of the mouth. As it turned out, however, it came in to be most serviceable. Within a fortnight of taking the casts the mother of the lad came to me in great distress, stating that her boy had got several of his teeth knocked out with a cricket ball. He had been attended to by the school doctor, who reported that his eye tooth had been broken, the lateral knocked right out and the central driven into the mouth, and it was

now so loose that he feared nothing could save it. She, however, thought that the dentist was the proper man to consult under the circumstances, and came to me to see what could be done. I recommended her to go to the school at once, bring up the boy, and be sure and bring the broken and knocked out teeth if they were still to the fore. In a few hours she returned bringing the boy and one tooth —the lateral—which after a diligent search had been found on the cricket field. This was thirty-six hours after the accident. The broken crown of the eye tooth was still attached to the gum when the doctor first saw him, and he had removed it and thrown it away.

On seeing the boy I recognised my patient of a fortnight ago, and producing the casts was able to show that the supposed broken canine was only the temporary one, and that its permanent successor lying snugly in the alveolar socket would soon make its appearance and more than probably prove free from injury. Now, to restore the lateral to its socket and the central to its right place in the arch, I filed a little bit off the end of the root, drilled through the coronal surface of the lateral into the pulp chamber, removed the dessicated pulp, filled the canal and pulp chamber with gutta percha and capped it with gold. I then washed the lateral in warm water and, after immersing it in a weak solution of bi-chloride of mercury, replaced it in its socket. The time I had been doing this my assistant had moulded a plate of shellac on the original model, to the lingual surfaces of the teeth and the palate. Holes were drilled in this behind the firm central incisor and the bicuspids. The displaced teeth were pushed back to their place in the arch, the plate inserted and tied in with silk, and the lad dismissed for the day. By the next day I had a similar plate made in vulcanite with the addition of a small cap of soft gold coming over the left central and incisor, which cap made certain that these teeth would not become elongated. The plate was worn a fortnight, and the teeth are now firmly fixed and healthy looking. I hope on some future occasion to show you the model of this mouth when the permanent canine has erupted.

The PRESIDENT also exhibited a case of cemental union between a second molar and a wisdom tooth extracted by Mr. Robb, of Dundee, from the mouth of a gentleman who had come to him suffering great pain, due to inflammation of the socket. Mr. Robb said he looked round the mouth to see if there was any other abnormality or malformation, but all that he noticed was that the man had a club foot.

Mr. RUSHTON showed some specimens of cemental union lent for the purpose by Mr. H. W. Dewes.

Mr. STOCKEN asked the strength of the solution of perchloride of mercury used in the case of transplantation.

The PRESIDENT said it was about 1 in 2000.

Mr. STOCKEN thought it must necessarily be very weak because perchloride of mercury combined with albumen and gelatine. The question arose as to whether it was preferable to a carbolic acid solution. He had treated a case with carbolic acid, and after a period of eleven years the tooth was still firm and in good condition.

Mr. STORER BENNETT asked whether it was intended to be understood that the specimen exhibited was one of cemental union of two teeth that had never been separated? He understood "cemental union" to mean two teeth that at one time had been separated, and had been united by cementum. If the specimen was examined with a magnifying glass he thought it would be evident that it was an odontome: it was not a specimen of two teeth that had been separately developed and subsequently united by cementum, but there was an actual union by dentine and enamel. He did not know whether it was intended to imply that the teeth had been developed separately and then become united by cementum, or whether it was supposed that the union was due to fusion of dentine and enamel.

The PRESIDENT said he had not determined that point accurately.

Notes on a Case of Anthrax. By Mr. H. G. Read.

On Tuesday, April 18, James Long, aged 16 years, was brought to me in the surgery at St. Bartholomew's Hospital, having a large œdematous swelling situated in front of his neck. In the middle line on the point of his chin immediately over the symphysis menti was a small yellow vesicle having an intensely red areola round it. On looking into his mouth I found that the right lower second molar was dead, the neighbouring gum being somewhat thickened and inflamed. This tooth I therefore extracted, considering it a possible though not probable cause of the neck trouble.

Having ascertained that the lad was engaged in stuffing chairs with horsehair, that he had quite recently experienced two rigors and that his temperature was 103°, I decided that he was probably suffering from anthrax, and therefore transferred him to Mr. Weir, the house surgeon on duty, who admitted him to Henry ward under Mr. Smith.

The dresser's note, taken late in the afternoon of same day, describes the seat of infection as consisting of a small black slough about two lines across, surrounded by a red though not very inflamed areola about a quarter of an inch in diameter. No vesicles could be made out, there was but little induration of the base of the pustule. He also describes the swelling in front of the patient's neck; it had considerably increased since the morning.

The following day I visited the patient at about 9 a.m. He had passed a very bad night, his temperature being 104°.2, large doses of quinine failing to reduce it. The pustule had increased a little in size, and around a central dry black slough was what I believed to be the remains of a ring of tiny blisters, the outlines of two or three being more or less distinct. The patient was very ill indeed, but in spite of his critical condition suffered neither anxiety nor distress. This absence of apprehension has been noted as a feature of this disease. At 7 p.m. the sore on chin was removed by the knife and the subcutaneous tissue scraped with a Volkmann's spoon; patient's tempera-

ture at operation was 104°.2. Subsequently patient passed a very good night. Twelve hours after the operation the temperature was 98°, a fall of 6°.2. He made a rapid recovery, being perfectly well by 23rd of April.

Some secretion from the sore, on microscopic examination, aided by cultivation, failed to reveal any anthrax organisms, though large numbers of bacilli of various kinds abounded in it. A small quantity, however, taken from the tissue removed at the operation was injected into a guinea pig, causing its death some hours later, and its blood was found to be swarming with anthrax bacilli.

Mr. Roughton said this case showed how important it was for those engaged in dentistry to have some knowledge of matters which did not directly concern the teeth. If that case had gone to any one less informed or less practised than Mr. Read no doubt the nature of it might have been overlooked, and the boy might not have obtained proper treatment until the disease had become too far advanced for relief. He had a similar case under observation recently, in which a man was admitted to the Royal Free Hospital with a sore place on the side of the neck, a black looking place very similar to the condition Mr. Read had described. The case was not under his own care, but he subsequently saw it ; he scratched one of the vesicles, examined the serum which came from it, and found it loaded with what were no doubt anthrax bacilli. The man was in an almost comatose condition, and although the malignant pustule was excised within a very short time after his admission to the hospital he succumbed within a few hours. If the case previously described had been allowed to go on, the result would no doubt have been the same.

Notes on a Case of Unilateral Bony Anchylosis of Right Temporo - Maxillary Joint. By Mr. A. Alex. Matthews.

A. B., a schoolboy, aged 13, was admitted into the Bradford Infirmary under the care of Mr. Wm. Horrocks, Sen. Surgeon to that Institution, with whom I watched the case.

History of the case is somewhat obscure. When 3 years old, patient, with right side of face swollen, and complaining of toothache, was attended at the Wakefield Hospital for disease of jaw. A lower decayed tooth was extracted. Two years later a sinus formed in front of the ear, and another formed behind the angle of the jaw, the latter appearing first. A piece of bone, the necrosed condyle and neck of jaw, was removed through the opening by the ear when he was 7 years old, after which the sinuses closed. For several years the patient was quite unable to separate the teeth, and food was taken by thrusting it between his teeth with his fingers.

On January 23rd, 1893, the face is asymmetrical, with considerable broadening of the right cheek. Behind and below the angle of the jaw, on the right side, is a depressed cicatrix. A linear scar is seen above the zygoma ; the tissues over the right ramus are much thickened. On placing the fingers over the temporo-maxillary joints, and directing patient to open his mouth, slight movement is felt on the left side, but the right is immovable. The right ramus, from zygoma to angle, measures one and a-half inches, the left two inches. On passing the finger into the mouth the mucous membrane is bound down to the bony thickening along the front of the ramus. The right masseter is thin, and contracts feebly. Patient is able to thrust the lower teeth a little in front of the upper.

On January 27th, 1893, patient having been anæsthetised with chloroform, a linear incision, three inches long, was made a quarter of an inch above, and parallel to the zygoma. The tissues were dissected down, and the upper part of the jaw exposed. The jaw was much broadened from before back, very dense in structure, and firmly anchylosed by bony union to the temporal bone. Near its upper part the jaw was sawed through with an Adams' saw, the division being completed with bone forceps. The jaws were then separated about an inch by a wedge gag inserted between the incisors. A small piece of bone was removed from the back of the ramus.

The wound was sutured, and healed by first intention in

four days. The jaws were subsequently separated by insertion of a screw wedge. On one occasion nitrous oxide was given and the jaws forcibly separated.

At present the separation between the canine teeth is rather greater on the right than on the left side. The separation of lower from upper incisors is five-eighths of an inch. The gliding or lateral movement of the jaw is imperfect. Patient is able to masticate his food without difficulty.

On May 17th the patient feels in excellent health. Can eat anything without difficulty or inconvenience. The separation of five-eighths of an inch is maintained. In opening the mouth the jaw moves downward with slight inclination to the right, and in the lateral movement the jaw is extended more to the right than the left side.

Remarks. — Cases of temporo-maxillary anchylosis are sufficiently rare to merit a review of some of the previous cases, and a comparison with the case under consideration. Mr. Heath ("Lectures on Some Diseases of Jaws," 1887) records a case of unilateral bony anchylosis from which he had removed half an inch of bone below the condyle. The case did well. In a case of bony anchylosis under the care of Dr. Abbe, New York, the apparent cause was suppurative otitis media. A vertical incision was made in front of the ear, and a horizontal one along the lower border of the zygoma. The parotid gland and facial nerve having been drawn down, the bone was divided with a chisel. The neck and condyle were removed piecemeal. Mr. Heath also relates a case in which he divided the jaw with an Adams' saw passed into a small incision above the last molar tooth. In the *Annals of Surgery*, February, 1893, is an account of a case of bilateral bony anchylosis, under the care of Dr. Borelli. The condition was due to a fall twenty years before. When seen the jaw was ill developed and receding, like an idiot's. The angles were very obtuse. The jaws could only be separated a millimetre. Vertical incisions were made on each side and the joints resected, so that separation between the incisors after the operation was five centimetres. Subsequently the condition recurred.

The early history of the present case is obscure, but the bony thickening over the front of the ramus and the absence of ear symptoms favour the supposition that the mischief began in the back of the alveolus. The width of the bone and the shortening from above down are due to removal of condyle and neck of jaw.

The incision was made above the zygoma, to avoid branches of the facial nerve, which in the present case apparently escaped division. A circular saw one inch and a-quarter in diameter, attached to a dental engine, was in readiness, but could not be used for dividing the bone owing to its deep-seated position.

Mr. Roughton asked for information on one point. It appeared that although there was bony anchylosis of one temporo-maxillary joint, there was a certain amount of movement in the opposite joint, and the boy was able to slightly protrude the lower teeth beyond the upper teeth. He would like an explanation how that movement took place. He did not quite understand what views were put forward with regard to the etiology of the joint disease in this case.

Mr. Matthews said the movement was only apparent on the left side. In the effort he made to open his mouth a little movement could be detected in the articulation on the left side by feeling closely. He also was able slightly to move the lower teeth forward; the movement was very, very slight, but could still be detected. The freedom of movement still remaining on the left side was sufficient to allow a slight movement. It was very difficult when a case was three years old to get the particulars of the early history. There was certainly no ear trouble, and the case seemed to resolve itself into one of tooth trouble followed by alveolar inflammation.

A Note on Chloride of Ethyl. By Mr. William Rushton.

As far as I am aware there is nothing original in the few remarks I am about to make, but I thought they might, perhaps, be of some little service.

I consider the best form of tube is that of Bengue's with

the screw cap. When the latter is screwed down, and the fluid kept in contact with it, there is no loss by evaporation. For this reason, and also for the reason that it is more generally useful than the straight nozzle, I prefer the bent nozzle, as by this means the drug can be kept in contact with the cap to the last drop. It is advisable not to have a nozzle with too large a bore, as in that case the supply is too plentiful, and the fluid runs about in an undesirable manner. Theoretically the supply and the evaporation should be exactly equal. A napkin placed behind the spot to be frozen and over the tongue prevents any excess from going down the throat. I prefer to hold the tube from eight to 12 inches from the point of application. Although the advertisements recommend it strongly for ordinary extractions, I find it of very little use except that it somewhat deadens the pain caused by the driving up of the forceps. For the extraction of stumps not too firmly adherent—as, for instance, the stumps left by the gradual decay of upper molars—it is very good. It is advisable to keep on spraying with the left hand while the right is engaged in extracting.

In making incisions in any part of the mouth it is excellent—as, for instance, cutting down upon a partially erupted wisdom tooth, lancing or drilling an abscess or cutting away overhanging gum. In driving up cap crowns it deadens the pain considerably.

It is in exposing pulps previous to devitalisation that I have been most surprised and pleased with its action. It is advisable to remove as much carious dentine as possible before applying the spray. The first shock of cold causes slight pain, but that passes instantly and is the only pain felt; the pulp can be freely exposed by excavator or drill without causing any further suffering. With a *free* exposure, the subsequent application of arsenical dressing gives practically no discomfort.

As far as my experience goes, it is useless as an obtunder for sensitive dentine, as the spray is more painful than that which it is intended to relieve.

Dr. Radcliffe Crocker, in a letter to the *Lancet* of

November 5th, 1892, gives a warning as regards its use. He used it for freezing a patch which he was about to scarify on the nose of a young lady. The freezing action was good, but "the patient turned pale, slightly livid, and stopped breathing, looking very like a person under nitrous oxide gas." He "certainly would not use it again to any part of the face when it was possible that the vapour could be inhaled." Of course, we do not know how long Dr. Crocker applied the spray, how much of the drug he used, how near he held the nozzle to the face, or how much, if any, found its way down the back of the nose to the throat, but I have used the spray pretty frequently for more than twelve months, and have never seen any of the disagreeable symptoms experienced by Dr. Crocker's patient. It, however, behoves us to be careful.

Discussion on the Treatment of Empyema of the Antrum.

Mr. W. R. Ackland said: I may as well at once confess, my object in opening this discussion is more to elicit information than to give it. The cases I have had are often so disheartening as regards results of treatment that I want rather to compare notes with my friends than pretend for one moment to offer anything original.

In order to give you ample time for discussion, I will only give you a few notes on salient points. And though in the agenda I see the discussion is limited to treatment, a few other notes may lead us to discuss points of interest.

(1) As to the nature of the disease we are going to discuss: to us as dental surgeons it chiefly means empyema or suppuration in antrum, since malignant disease is beyond our sphere, and we no longer consider cystic (or hydrops antri) as primarily an antral affection.

(2) Cause may be either a tooth, and it is generally this; or a nasal affection, as polypus or ozœna.

(3) With regard to symptoms. Of course, pus from the nostril is the best recognised. Neuralgia I have seldom

found, except when the antrum was distended, and *no* pus came from nose.

(4) Diagnosis would rest on the presence of *pus*, chiefly if discharge existed; and Heath points out that the discharge in ozœna is not offensive to the patient, as in these cases the sense of smell is gone.

I have seen percussion of the palate advocated. I have tried it, but could not get any difference in sound on either side. Electric illumination I know nothing about, but should like information from some of the members present.

Treatment.—I noticed some years ago in the *British Medical Journal* a description of Meculicz's operation, which consisted in perforating the inferior meatus. I tried it in two cases, using a special drill in the dental engine, with unsatisfactory results. It offered no advantage, that I could find, over the better-known method. I generally perforate through the alveolus with an ordinary straight elevator, using a cork on it to prevent pushing too far. Then I fit a small vulcanite plate [shown] fastened to adjoining teeth and carrying a spur (not a tube), which projects into the hole and keeps it open. I give the patient a black vulcanite syringe, and instruct him to syringe two or three times a day.

As to antiseptics, one finds that the antral, like other mucous membranes, gets accustomed to any one lotion, and we get best results by ringing the changes.

Directly the hole is bored I syringe repeatedly—for about ten minutes on end — with fairly hot water, in order to remove all collected matter from the possible divisions or pockets. Then I give the patient lot. acidi borici, trying next, perhaps (after three or four days), zinc chloride or zinc sulphate, grs. ij. to ʒ, Condy, or phosphoric acid, 1 in 18 or 20. On one occasion, after months of syringing with various antiseptics, I finally cured a case with pot. chlor. solution, about 5 grs. to the ounce.

Mr. S. J. Hutchinson said these cases were of great interest. They generally took a very long time in recovery. He had lately met with a case in which some bone mischief was due to a polypus which had extended

through the opening of the middle meatus, and some caries of the bone had kept up a constant secretion of pus. Very often such cases which they treated from a dental point of view might have a deeper seated origin than was at first suspected, and that might be the cause of their necessitating such a very long course of treatment. He was quite sure that in many of these cases there was a tiny spiculum of dead bone somewhere, either on the nasal side of the antrum or probably in the neighbourhood of the aperture which had been made communicating with the mouth. That was certainly one of the causes of pus in the antrum that should be looked for, and it was one which would often be found to keep up irritation when no other trouble could be discerned.

Mr. Stocken mentioned that in two cases that came under his observation he had used chlorate of potash and a solution of iodine and iodide of potassium. Both cases proceeded successfully. He used a different mechanical contrivance to that mentioned by Mr. Ackland. He made a gold tube, of appropriate length, of a slightly conical form, with a broad gold flange, and round the outside of the tube soldered a gold spring wire. It had a spiral form, and there was no difficulty whatever without any other attachment in keeping it in its place. The patients were able to syringe through it as often as they pleased without any inconvenience. He thought that was better than a solid plug, because it allowed pus to escape where a solid plug would not do so.

Mr. Read said the hollow tube was a very difficult thing to keep clean. He had used the solid plug and found no inconvenience; it could be easily removed and replaced. He preferred a conical stem with a cap at the end. One case of diseased antrum which was somewhat difficult to treat, did very well with a packing of iodoform gauze, changed two or three times a week. After a time the discharge ceased, the packing was discontinued, and the patient made a good recovery. He suggested the use of a two-way syringe for washing out the antrum. Mr. Ewbank

used sometimes a piece of gold spiral spring for the tube and when the opening into the antrum was tortuous it seemed to be a useful plan to bear in mind.

Mr. Boyd Wallis suggested the use of the electric light in order to ascertain whether there was accumulation of matter in antral disease. It would enable the detection of any thinning of bone and show whether pus was present.

Mr. Storer Bennett said he had placed on the table a large collection of sections of upper jaws, presented many years ago by Mr. Cattlin, showing how many cases were met with having little pockets and processes of bone dividing the floor of the antrum into a number of sacs. This helped them to understand many of the difficulties met with in treating these cases, it being often extremely difficult to thoroughly wash out the different pockets. Either inspissated pus or foreign bodies, or pus itself, might collect in the little loculi; the syringe got at one portion of the cavity only, and the other parts were never cleared out at all. In some of the specimens the floor of the antrum was divided into three different spaces. A similar plate to that exhibited by Mr. Ackland had been used in the Dental Hospital for some years. It was quickly made, inexpensive and served its purpose admirably. As soon as the floor of the antrum was closed over, the plate could be shortened to the required length and finally abandoned. It was also very useful in keeping patent sinuses leading into parts other than the antrum. With regard to the solutions used for syringing, it was, no doubt, necessary to ring the changes. Like all other mucous membranes, that of the antrum became rapidly tolerant of any drug, and, therefore, it was not difficult to understand why, after using strong chloride or sulphate of zinc for a time, chlorate of potash had to be used, and, finally, a weak solution of anything, so long as it kept the part clean, would be all that was necessary.

Mr. G. Cunningham said that apart even from the bony divisions the folds of the mucous membrane ran up and left very distinct and large pockets. With regard to the point

raised some three years ago by Dr. Semon as to the increasing frequency of this antrum disease, since receiving notice of that meeting he had met with a case which came before him in a rather curious way. The man had been treated in a hospital for broken jaw. He described himself as having been troubled with neuralgia nearly all his life. After a severe attack of pain he consulted a dentist and had a tooth extracted, the roots of which were partially eaten away by abscess. Obtaining no relief, he consulted a second dentist, and having taken gas he was informed that he would have no further trouble, that a stump had been extracted, and there was no abscess. Finding himself much worse, he went to the local doctor, who told him his jaw had been damaged and that the stump had been left in. Several parts of the bone gradually came away. Subsequently the man came to him (Mr. Cunningham), and the stump was extracted. There was a distinct distension on one side of the face. The mouth was in a very neglected condition, but the only thing he could see was that there seemed to be a small root left in the molar region. This was easily removed, and by means of a probe an opening into the antrum was discovered. A large amount of pus exuded. The source of irritation, viz., the molar root, being removed, the case rapidly recovered, there being no signs of any further pus formation. In these cases he advocated the use of a solution of saccharin in alcohol, that being the most efficient antiseptic where it could be used in large quantities without deleterious effect. The improved condition from its use was very marked, and meanwhile the man was free from pain. During the discussion on Dr. Semon's paper he had mentioned a case where the opening into the nose was entirely blocked. It was proposed to the patient that an opening should be made through the meatus, but he declined. It was interesting to know that that case had gone on very well, and the patient was justified in his refusal. The parts had, after a long and tedious treatment, healed up entirely, and there was no recurrence of the trouble.

Mr. W. Hern said it was important to differentiate between cases occurring as the result of mischief originating in the nose, and those which arose from the teeth, because on a correct diagnosis depended another point—whether the antrum should be opened, and where it should be opened. There were two varieties of the disease: one obstructive, in which there was an empyema, and, as a rule, acute inflammatory symptoms; and the other, a non-inflammatory chronic condition, where the symptoms were more obscure, and the diagnosis was arrived at by a process of exclusion as well as by ascertaining certain facts, one especially of periodic discharge of matter down the nose or on the soft palate in the morning. The point as to whether the mischief arose from the nose or teeth was very important, because if it arose from the nose the question arose as to whether they were to sacrifice a good tooth or to open the antrum, which did not lead always to sacrificing a tooth. It would be conceded that if the mischief was due to a tooth, that tooth should be removed and the antrum opened through the socket. If the mischief arose in the region of the nose, then it was a question whether the antrum should not be opened without sacrificing a tooth, and what was the best position for so doing. In Dr. Semon's paper it was suggested to open up the cavity from the canine fossa. There was one point on which the after treatment depended, namely, to get the opening in the most dependent position; but if it was made in the canine fossa it would be more difficult to carefully drain the antrum. For opening the antrum Mr. Ackland preferred the elevator. There were cases where something more than an elevator was necessary, and the dental engine armed with a special burr was one of the best modes of getting through hard bone in such cases. Mr. Heath was the first to point out that where the opening was patent into the nose, the patient could be taught to wash out the antrum without any syringe at all—by taking a large mouthful of water, putting pressure on it with the tongue, and driving it through the antrum. He had had one or two cases at the hospital where the patients could

do that with great facility, and it made the after treatment very much more simple. As to the time when the openings should be allowed to close, he thought if there was no foreign body and no discharge, after the antrum had been kept fairly clean from pus for a week or ten days, the openings should be allowed to heal of their own accord.

Mr. Roughton wished to know whether anyone present had ever seen the inside of an antrum which had been the seat of empyema, and if so, what the pathological condition was; without knowing that, they might as well try to treat some difficulty in the next room by squirting through the keyhole. In these cases there was discharge going on a long time through the socket of a tooth which had been extracted, but the condition of the mucous membrane inside the antrum was almost entirely unknown. If they could collect information from people who had seen the inside of the antrum in such cases, it would be of the very greatest value. It was quite possible that there were several different classes of cases of empyema. Of course there might be some arising from the nose and others from the mouth, but apart from that the condition of the antrum might vary largely. Sometimes there might simply be purulent inflammation of the mucous membrane itself; in other cases—owing to the existence of septa passing across the floor of the antrum, very largely increased in depth by the mucous membrane over the bone—the prevention of drainage might be quite sufficient to prolong a case indefinitely. Then again it was quite possible that some small piece of necrosed bone in the immediate neighbourhood of the socket of a tooth might be the cause, and they knew that in surgery as long as there was a piece of dead bone at the bottom of a sinus, so long would that sinus continue to discharge. It was quite possible also that some mucous cysts might suppurate, and keep up the trouble. In a case of empyema of the antrum which did not get well by syringeing, it was the duty of the surgeon to adopt some more radical procedure. As soon as an opportunity arose he intended to operate in this way: to draw the cheek well

back and divide the mucous membrane between the cheek and gum so as to expose the anterior wall of the antrum; then by means of a stout knife or any suitable instrument make a hole into the cavity, cutting along three sides of a small square and then breaking the bone, leaving it attached above by the muco-periosteum; then pass in a small electric light on the end of a handle and actually see what was the condition in the antrum. He had done the operation several times on the dead body, and the view obtained of the interior was perfect. Of course, on the living subject the operation would not be quite so easy, and hæmorrhage might obscure the view; but a stream of water keeping it washed out would show the condition of the mucous membrane, and there would then be some chance of treating the disease.

Mr. Mummery mentioned that in a case which had become chronic and lasted two years, he, with the assistance of a surgical friend, cut away the whole of the floor of the antrum so that they could pass their two fingers in and see the whole of it. They found dead bone on the inner wall, and by scraping away the dead bone the discharge stopped. Pus again collected and this was got rid of by scraping down very freely the inner wall of the antrum with a sharp spoon. Referring to Mr. Cunningham's statement as to the use of saccharin, he said saccharin by itself was not an antiseptic, but combined with benzoic acid it was a powerful antiseptic.

Mr. Cunningham said as a matter of fact it was combined with benzoic acid; but Professor Miller in his book described the antiseptic value of saccharin in alcoholic solution. That was a point that had better be cleared up by referring to the authority.

Mr. Maggs advocated the free opening of the antrum by means of a good-sized gimlet so that it could be washed out thoroughly and free drainage obtained. Mr. Ackland seemed to expect some pathognomonic symptoms. It was very rare to get pathognomonic symptoms, and the one

mentioned by Mr. Hern—pus in the mouth on rising in the morning—was not always present. One liked to find it present, of course, but there were cases in which it did not occur. With regard to the electric light, he remembered a case which was reported, in which it was stated that with the electric light it was impossible to make out any difference between the antrum walls on the two sides; but not withstanding that, the antrum on the suspected side was opened and pus was found in it. Later on, the cavity on the opposite side was opened and pus was also found present there. He thought that the operation described by Mr. Roughton was rather a formidable one, and supposed that it would only be resorted to when the usual methods of treatment had failed.

Mr. Roughton said, of course he would not advise an operation such as he had described at once. It would be only for cases that had gone on for a very long time, showing that ordinary treatment would not cure them.

Mr. Robbins called attention to a case that was exhibited at a previous meeting by Mr. Newland-Pedley. In that case an operation was performed on the lines advised by Mr. Roughton, but to a larger extent, the trap door being cut clean away. It was a very chronic case, and had hitherto defied all treatment. A vulcanite flap was made attached to a denture, which acted as a trap door.

Mr. Ackland briefly replied, thanking those who had taken part in the discussion for their kind hints. He had found polypi keep up the discharge, and had treated one case in conjunction with a nasal specialist.

He thought that Mr. Stocken must use some plug in his tube to keep food out, and considered that the tube and plug must amount very much to the same thing as the solid plug which he (Mr. Ackland) used.

Mr. Ackland remembered an allusion to the operation described by Mr. Roughton in Heath's "Diseases of the Jaws," but considered it an operation only to be undertaken by the general surgeon.

The PRESIDENT called attention to a paper read before the Edinburgh Odonto-Chirurgical Society in March last by Dr. MacBride, the nose specialist, in which he treated this subject from a surgical as well as a dental point of view. The discussion on that paper had followed very much the same lines as the present discussion.

After the usual vote of thanks to the authors of the communications, the meeting was adjourned to Nov. 6.

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ILLUSTRATIONS.

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